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ENGLISH FOR TODAY

BOOK FOUR
Our Changing World

THE NATIONAL COUNCIL
OF TEACHERS OF ENGLISH

ENGLISH FOR TODAY

Book Four

OUR CHANGING WORLD

by **The National Council of Teachers of English**

Project Director and General Editor:

WILLIAM R. SLAGER, Department of English
University of Utah

Writers and Contributors

Donna H. Carr
Bernice E. Leary
John Maxwell
James Sledd

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OUR CHANGING WORLD—Student Text

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TO THE STUDENT

Our world is changing rapidly. Every day we are going farther faster. Sixty years ago we didn't have airplanes, yet today we are sending men into space. Every day we are sending news faster. Today a family in San Francisco can sit in its living room and watch a live television program from Paris. And every day we are conquering more diseases. Less than ten years ago people feared the dreaded disease called polio, yet today powerful vaccines have almost wiped it out.

Our changing world is not always comfortable and secure. Many people don't like to change. They like life the way it is. Yet more changes are coming: Ten years from now few people will live the way they are living today. *Our Changing World* is going to look at many kinds of changes.

Probably many of these changes have already affected you in some way. As you go through the readings, you can pick out specific examples of changes that have affected your everyday life. You can then describe these changes in detail and discuss their value. Though they are neither all good nor all bad, they are inevitable. And we need to think about them if we are going to prepare ourselves for the complex world of tomorrow.

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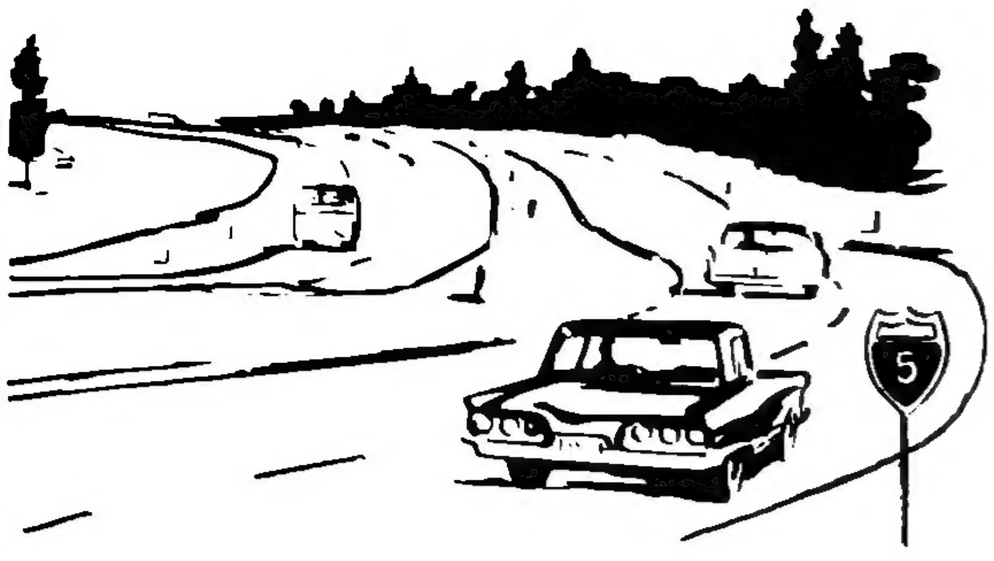
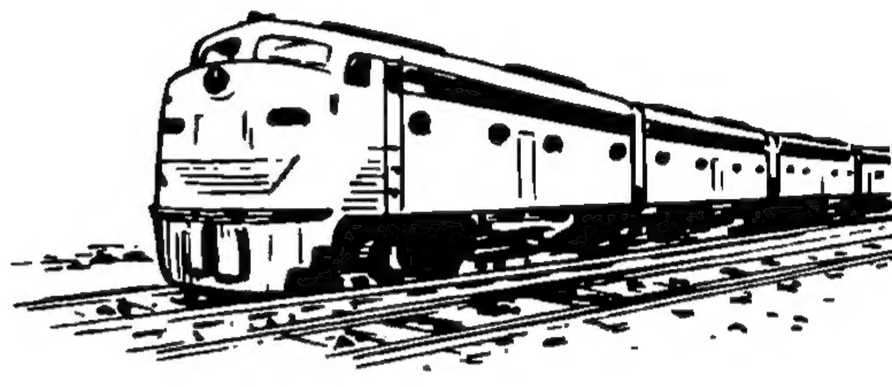


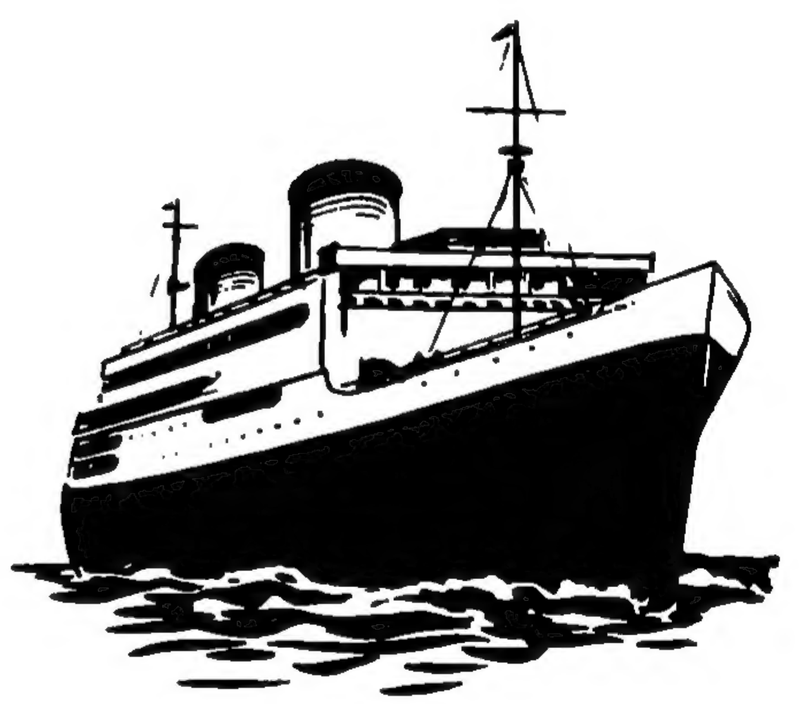
Unit 1: TRANSPORTATION

Cars

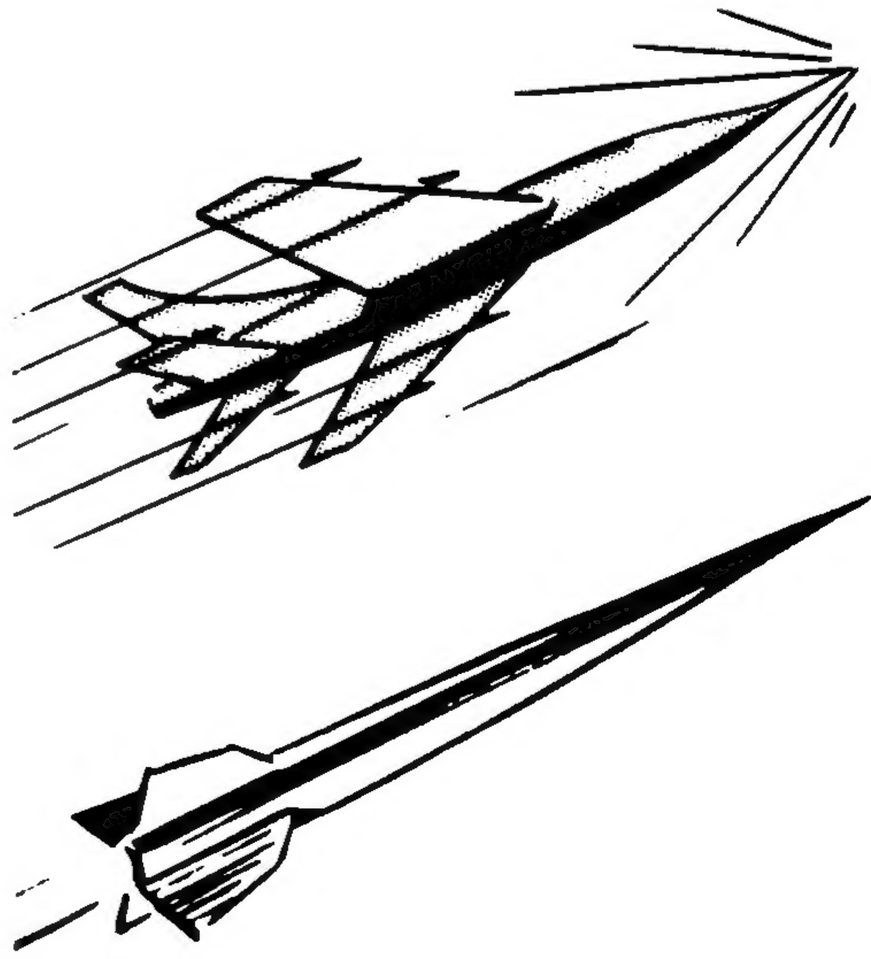
Trains



Ships



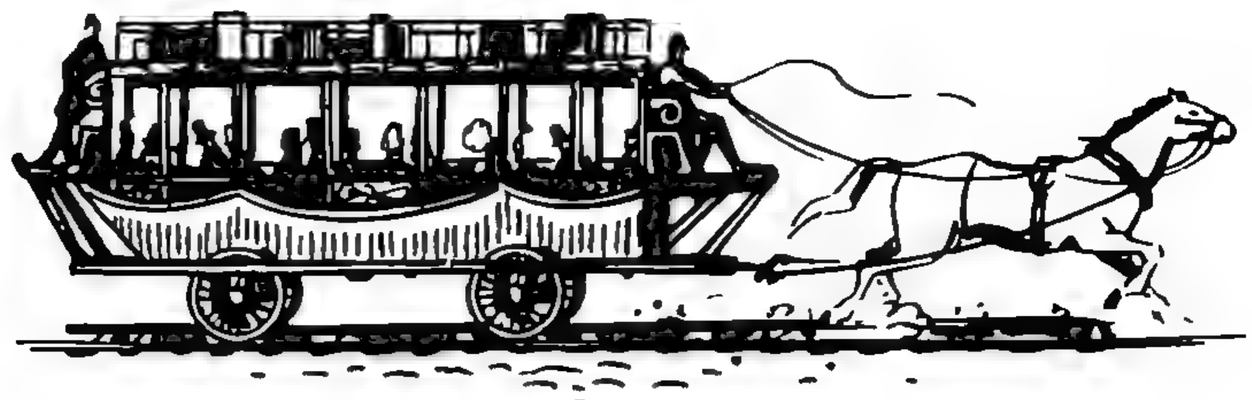
Jet planes

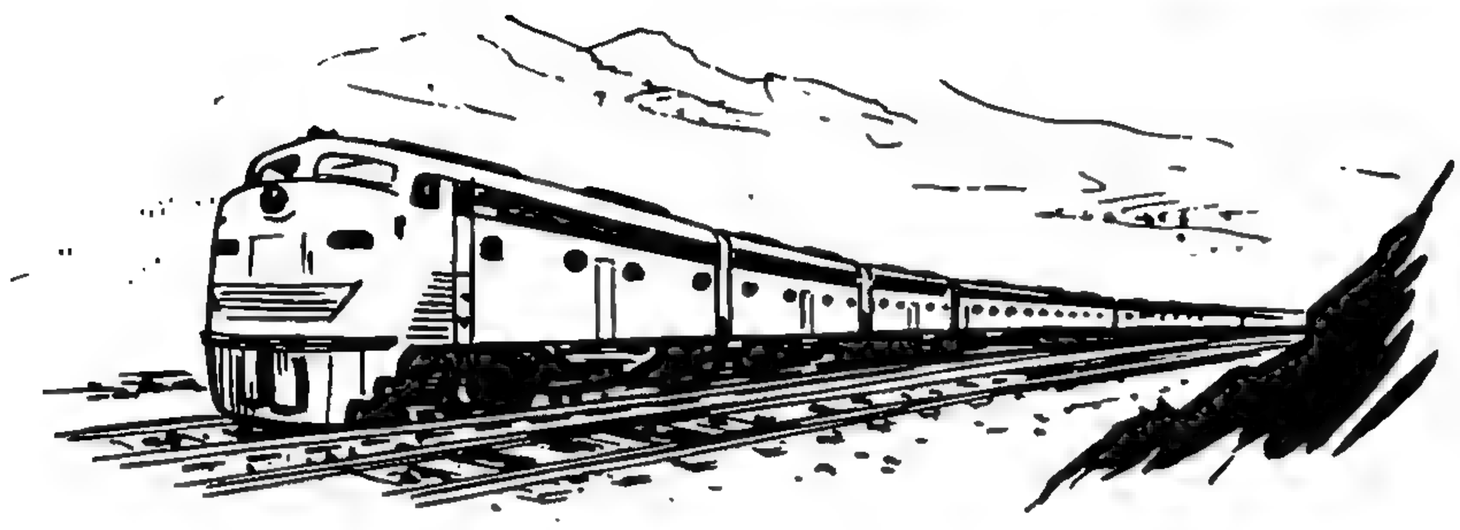


Rockets

One: TRANSPORTATION ON WHEELS: TRAINS AND AUTOMOBILES

From horsecars to modern trains and automobiles



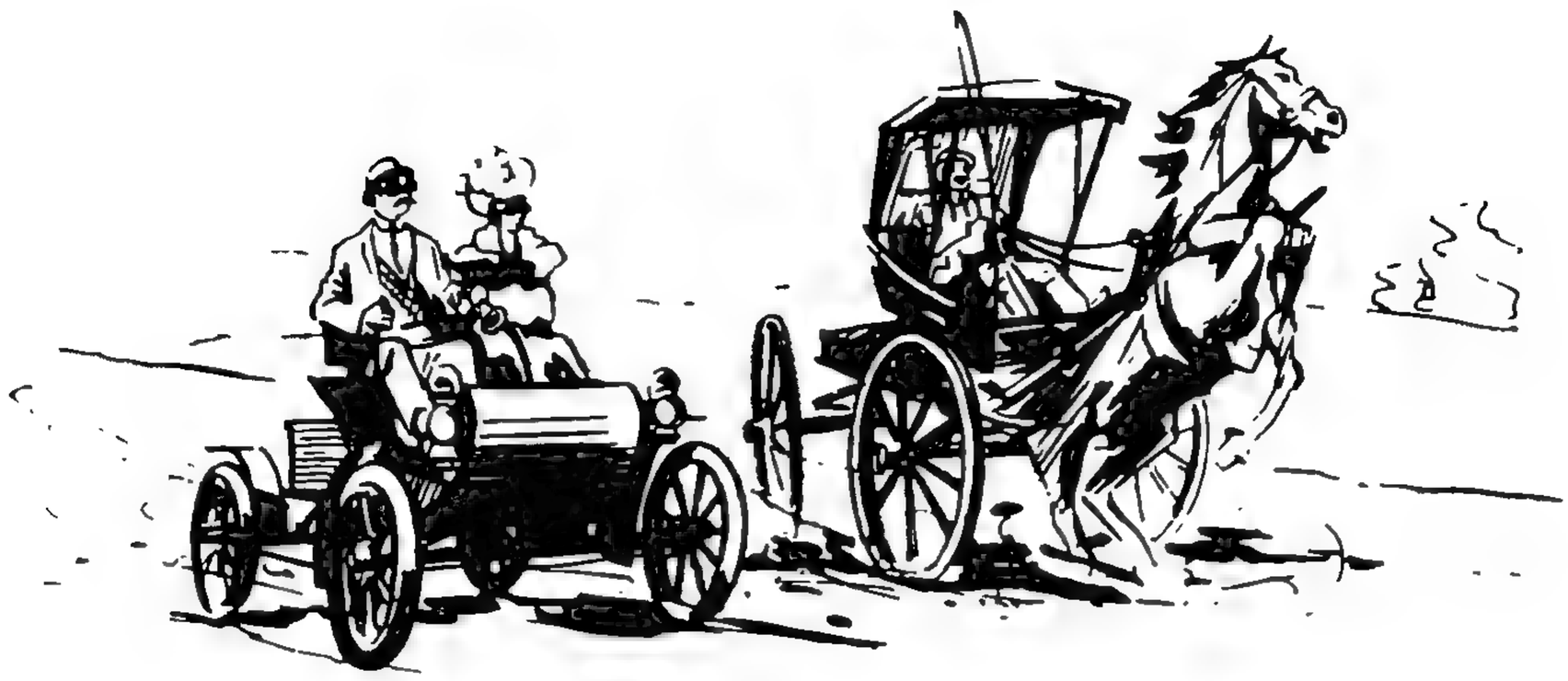


1] It's hard to imagine a horse pulling a railroad car. But it wasn't long ago that horses did just that. Many of the early cars were pulled by horses. And these cars weren't easy to pull, either. They didn't have steel wheels that moved smoothly over steel rails. Both the wheels and the rails were made of wood.

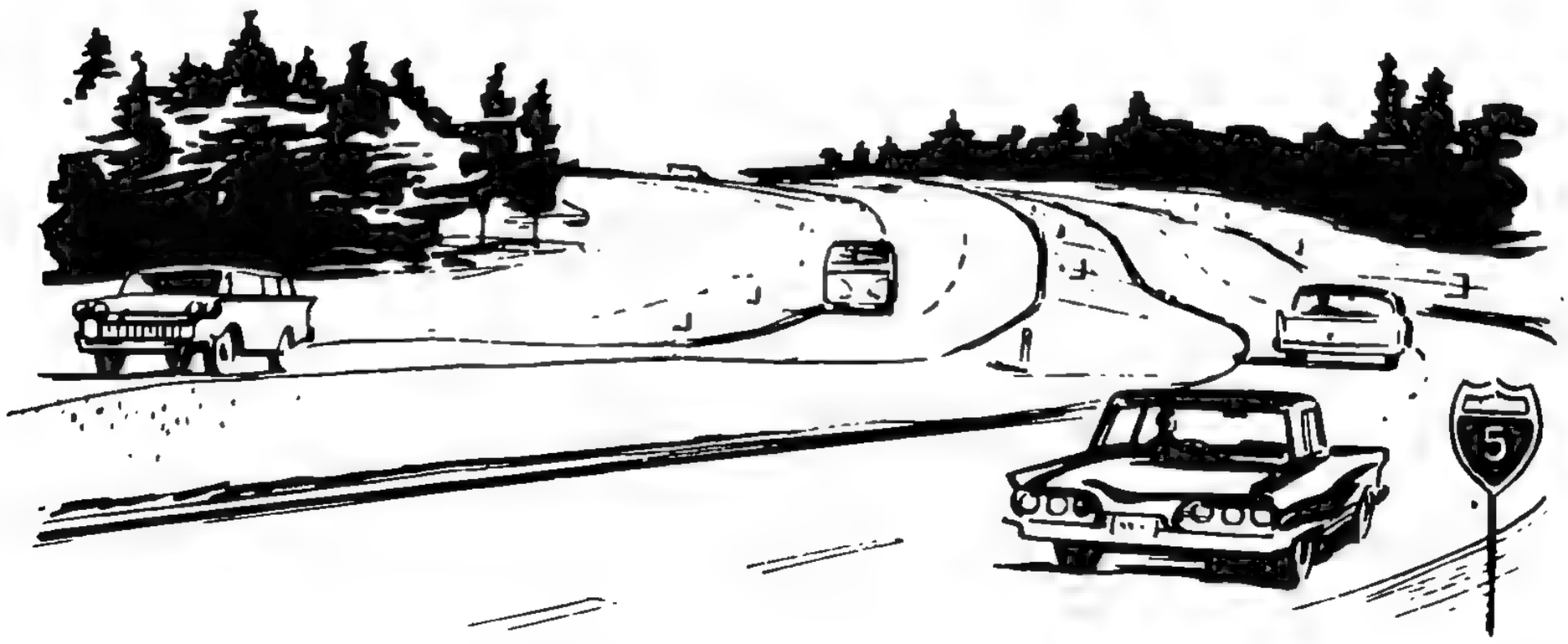
2] Today the horses have been replaced by giant locomotives that are powered by steam, by diesel engine, or by electricity.

3] The steam engine, which was perfected by a Scotsman named James Watt, was the first to provide power for the new trains. At one time all locomotives had steam engines. But today in many countries steam engines are being replaced by diesel engines. Diesel engines were invented by a German named Rudolf Diesel. They are less expensive to run because the fuel oil that they use does not cost as much as the coal used in steam engines. Still another source of power is the electric engine, which is used extensively in many countries like Japan. In Japan there is little coal, but there are many rivers that can be used to produce electricity.

4] Like trains, automobiles have improved rapidly. Early automobiles [1] were sometimes only "horseless carriages" powered by gasoline or steam engines. Some of them were so noisy that cities often made laws forbidding their use because they frightened horses.



5] Many countries helped to develop the automobile. The internal combustion engine was invented in Austria, and France was an early leader in automobile manufacturing. But it was in the United States after 1900 that the automobile was improved most rapidly. As a large and growing country, the United States needed cars and trucks to provide transportation in places not served by trains.



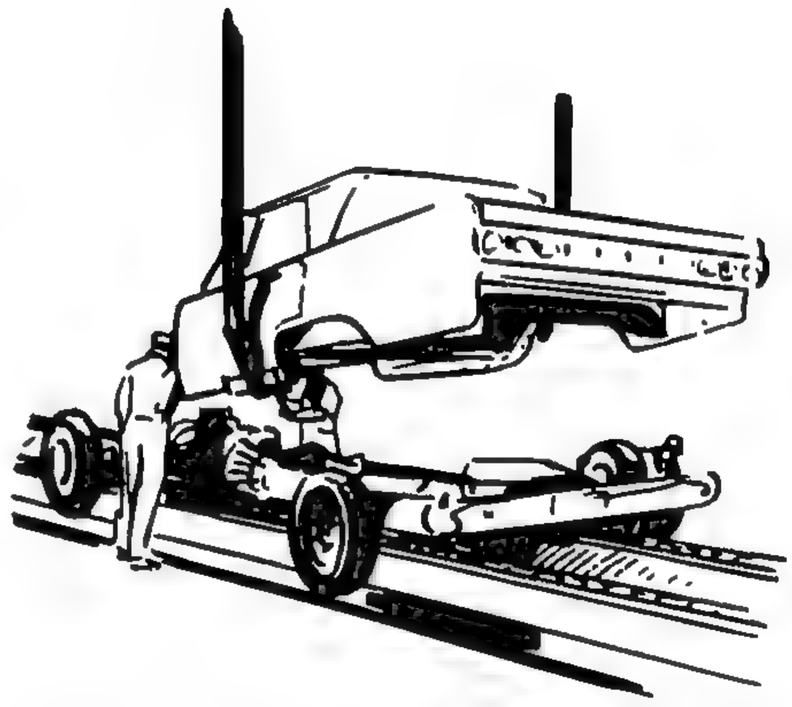
6] Two brilliant ideas made possible the mass production [2] of automobiles. An American inventor named Eli Whitney introduced one

[1] Words and phrases followed by a number are explained in Notes on the Readings at the end of the book.

of them, which is known as "standardization of parts." In an effort to speed up production in his gun factory, Whitney decided that each part of a gun could be made by machines so that it would be exactly like all the others of its kind. For example, each trigger would be exactly like all other triggers. A broken trigger could then be replaced immediately by an identical one. After Whitney's idea was applied to automobile production, each part no longer had to be made by hand. Machines were developed that could produce hundreds, even thousands, of identical parts that would fit into place easily and quickly.

7] Another American, Henry Ford, developed the idea of the assembly line. Before Ford introduced the assembly line, each car was built by hand. Such a process was of course very slow. As a result, automobiles were so expensive that only rich people could afford [3] them. Ford suggested a system in which each worker would have a special job to do. One man, for example, would make only a portion of the wheels. Another would place the wheels on the car. And still another would insert the bolts that held the wheels to the car. Each needed to learn only one or two simple acts.

8] But the really important part of Ford's idea was to bring the work to the worker. An automobile frame, which looks like a steel skeleton, was put on a moving platform. As the frame moved past the workers, each man could attach a single part—wheel, engine, steering wheel, body, horn, and other parts. When the car reached the end of the line, it was completely assembled. Oil, gasoline, and water were added, and the car was ready to be driven away. With the increased production made possible by the assembly line, automobiles have become much cheaper.



Bringing the work to the worker

9] Now thousands of cars come from the assembly line in a single day. More and more people travel by car or bus, and more and more products are carried by trucks. It looks as if.the whole world will soon be on wheels.

GRAMMAR REVIEW: *Yes-No* Questions

Model: Rivers can be used to produce electricity.
Can rivers be used to produce electricity? Yes, they can.
Horses have been replaced by locomotives.
Have horses been replaced by locomotives? Yes, they have.
The early railroad cars were easy to pull.
Were the early railroad cars easy to pull? No, they weren't.

1.1 Turn the following statements into questions that can be answered with *yes* or *no*. Refer to the reading as you choose between *yes* and *no* answers.

1. Machines could produce hundreds of identical parts.
_____? Yes, they could.
2. The parts would fit into place easily and quickly.
_____? _____
3. One man would make only a portion of the wheels.
_____? _____
4. Each man could attach a single part.
_____? _____
5. Horses have been replaced by donkeys.
_____? _____
6. Automobiles have improved rapidly.
_____? _____
7. Automobiles have become much cheaper.
_____? _____
8. Automobiles have become more expensive.
_____? _____
9. The early railroad cars were pulled by horses.
_____? _____
10. The early railroad cars were pulled by donkeys.
_____? _____
11. The early railroad cars were hard to pull.
_____? _____
12. The rails of the early railroad cars were made of steel.
_____? _____
13. The rails of the early railroad cars were made of wood.
_____? _____

Model: The early railroad cars had wooden wheels.
Did the early railroad cars have wooden wheels? Yes, they did.
Fuel oil costs as much as coal.
Does fuel oil cost as much as coal? No, it doesn't.
More and more people travel by automobile.
Do more and more people travel by automobile? Yes, they do.

1.2 Follow the model as you turn the following statements into questions that can be answered with *yes* or *no*. Refer to the reading as you choose between *yes* and *no* answers.

1. The early railroad cars had steel wheels.
_____? No, they didn't.
2. Fuel oil costs more than coal.
_____? _____
3. Fuel oil costs less than coal.
_____? _____
4. Coal costs more than fuel oil.
_____? _____
5. Cities made laws forbidding automobiles.
_____? _____
6. Cities made laws forbidding horses.
_____? _____
7. Automobiles frightened horses.
_____? _____
8. The United States needed cars and trucks.
_____? _____
9. Whitney introduced the assembly line.
_____? _____
10. Whitney introduced standardization of parts.
_____? _____
11. Identical parts fit into place easily.
_____? _____
12. An automobile frame looks like a steel skeleton.
_____? _____
13. Thousands of cars come from the assembly line in a single day.
_____? _____
14. More and more people travel by car.
_____? _____

INTENSIVE QUESTIONING: *Yes-No* Questions

Refer to the reading as you choose between *yes* and *no* answers.

1. Were the early railroad cars pulled by horses? Yes, they were.
2. Were the early railroad cars pulled by donkeys? No, they weren't.
3. Were the cars easy to pull? No, they weren't.
4. Were they hard to pull? Yes, they were.
5. Did the early railroad cars have steel wheels? No, they didn't.
6. Did they have wooden wheels? Yes, they did.
7. Were the rails made of wood? _____
8. Were the rails made of steel? _____
9. Have horses been replaced by locomotives? _____
10. Have horses been replaced by donkeys? _____
11. Are locomotives powered by steam? _____
12. Are locomotives powered by electricity? _____
13. Were diesel engines the first to provide power? _____
14. Were steam engines the first to provide power? _____
15. Was the steam engine perfected by a Scotsman? _____
16. Was the steam engine perfected by a German? _____
17. At one time, were all trains run by steam engines? _____
18. Are steam engines being replaced by horses? _____
19. Are steam engines being replaced by diesel engines? _____
20. Were diesel engines invented by a German? _____
21. Were diesel engines invented by a Scotsman? _____
22. Are diesel engines less expensive to run? _____
23. Are diesel engines more expensive to run? _____
24. Does fuel oil cost as much as coal? _____
25. Does fuel oil cost more than coal? _____
26. Does fuel oil cost less than coal? _____
27. Does coal cost more than fuel oil? _____
28. Is coal used in steam engines? _____
29. Is fuel oil used in diesel engines? _____
30. Is fuel oil used in steam engines? _____
31. Is coal used in diesel engines? _____
32. Are electric engines used in Japan? _____
33. Is there a lot of coal in Japan? _____

Understanding Ideas

1. What are the three main sources of power for railroad engines? What are the advantages and disadvantages of each?

2. How does standardization of parts help to make mass production possible?

3. How does the assembly line help to make mass production possible? How does an assembly line work?

Applying the Reading

1. Have you ever taken a trip on a passenger train? In an automobile? On an airplane? If you had your choice, how would you prefer to travel—by automobile, by train, or by plane?

2. What are the principal railroad routes in your country? What are some of the important cities connected by these routes?

3. Which is more important in your country right now—new highways, new railroad routes, or new air terminals?

Composition

1. Notice that the subject of the third paragraph is given in the sentence that precedes it: *Today the horses have been replaced by giant locomotives that are powered by steam, by diesel engine, or by electricity.* This kind of sentence is called a *topic sentence.* Pick out the first reference to each of the three sources of power. Copy the paragraph carefully, paying attention to spelling and punctuation.

2. Notice that the first sentence of paragraph 4 relates the subject of the preceding page (trains) with the subject that is to follow (automobiles). This kind of sentence is called a *transitional sentence.* What idea is used to connect trains with automobiles?

3. The topic sentence of paragraph 5 is *Many countries helped to develop the automobile.* How many countries are mentioned in this paragraph?

Two: TRANSPORTATION BY WATER: SHIPS

From sails to atomic power

1] For thousands of years men had to depend on sails to catch the wind [1] and move their ships. But these early sailing ships had certain disadvantages. They were slow and clumsy, and they could not carry much cargo. If the trip was long, the cargo spoiled. And worst of all, there was real danger in depending on the wind alone. A calm sea could trap sailors for many days without water to drink, while a heavy storm might tear the sails so badly that they were useless.

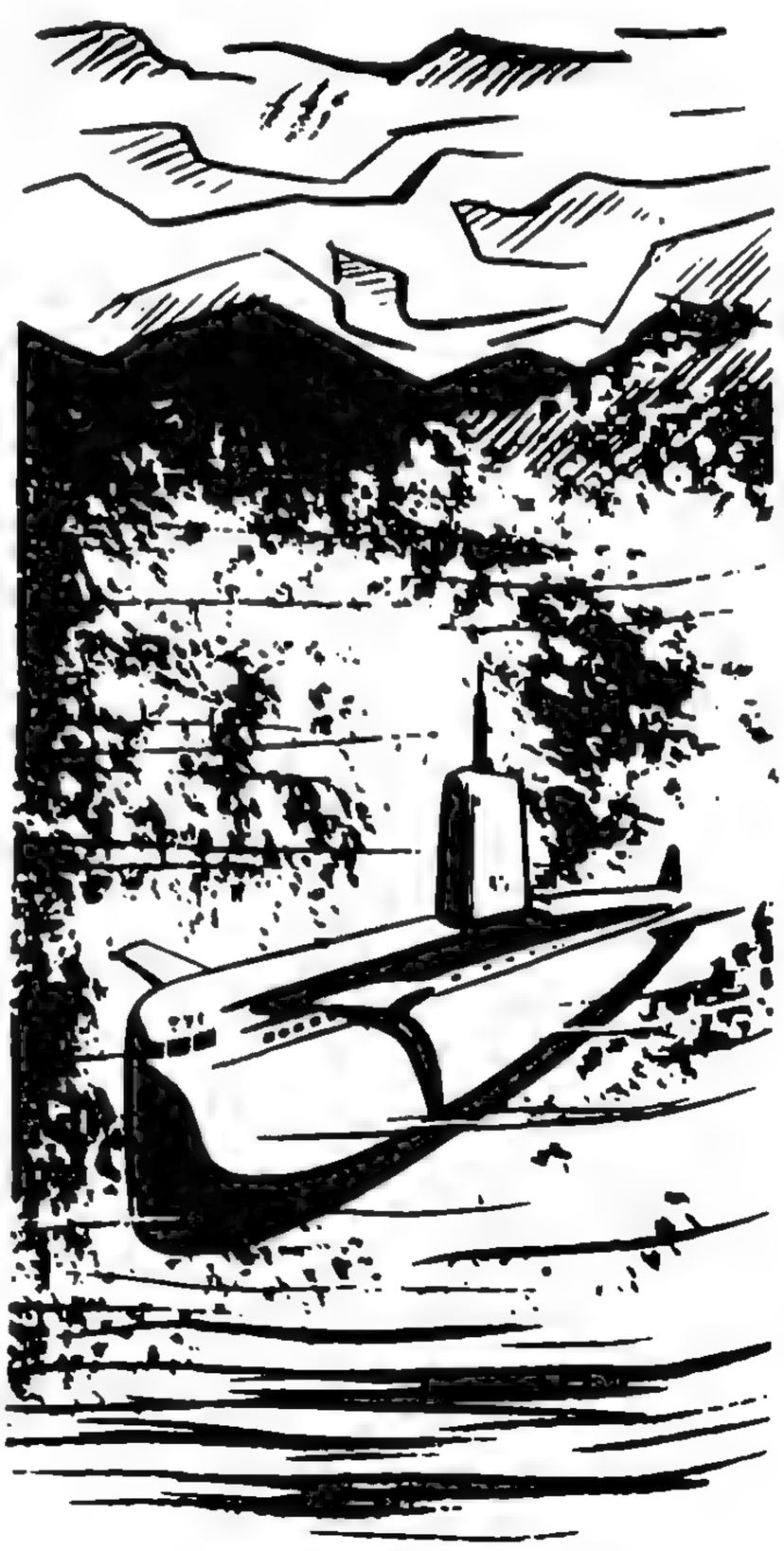
2] The great need was for ships that could sail anywhere in any weather. More sails were added, and the front ends of the ships were shaped more and more like knives to cut the waves. The result was a speedier ship as well as a more dependable one. But still these ships could not go fast enough. By 1900 very few sailing ships were being used for carrying passengers and cargo.

3] The change from sailing ships to steamships was gradual. At first steam power was added to wind power, and for a hundred years they were used together. In fact, the inventor of the steam engine, James Watt, doubted that steam should be used without sails, especially in rough water.[2] But little by little,[3] as the steam engine improved, steamships completely replaced sailing vessels.

4] One major drawback of steamships remained. Their boilers took up too much space, and so did the coal that was used for fuel. But with the introduction of the diesel engine, which uses fuel oil, space for boilers and coal storage was no longer needed. The diesel engine made motor ships possible. Motor ships can carry more cargo because the fuel oil they use is less bulky to store than coal and the engines do not need boiler space. They are also safer and less expensive to run.

5] Now a new source of power is being developed. It is atomic energy. With atomic power, submarines can operate much more efficiently under water. Because they do not need oxygen to work, nuclear submarines can stay under water for an almost unlimited time. And nuclear power can produce far greater speeds than conventional power.

6] Nuclear-powered submarines have broken all earlier records for speed and time submerged.[4] In 1958 the USS *Nautilus,* a nuclear submarine, made history by sailing under the North Pole. In 1960 the *Triton,* powered by two nuclear plants, traveled around the world under water, covering over 40,000 miles in eighty-four days. In the same year the nuclear submarine *Seadragon* made the first underwater trip from the Atlantic to the Pacific Ocean in the sea north of Canada.



A nuclear submarine

7] At the moment, atomic power is expensive for merchant ships. But the first atomic-powered merchant ship, the *Savannah,* has already been launched. And passenger lines are now being planned that will take passengers and cargo all around the world, using only tiny amounts of atomic fuel.

GRAMMAR REVIEW: *Wh* Questions: *Who* and *Whom*

Model: Mr. *and* Mrs. *Mallory* took a vacation last year.
Who took a vacation last year? Mr. and Mrs. Mallory.

2.1 Follow the model as you make questions with *who*.

1. ***Dick Mallory and his wife*** went to South America.

_____

2. ***The Mallorys*** traveled by ship.

_____

3. ***Dick's wife*** likes to travel by ship.

_____

4. ***Dick's wife*** had worried about leaving the children.

_____

5. ***Dick's mother*** could take care of the children.

_____

Model: Dick met *the captain of the ship.*
Did Dick meet the captain of the ship? Yes, he did.
Who did Dick meet? The captain of the ship.

2.2 Follow the model as you ask two questions.

1. Dick knows ***the captain's brother.***
   _____? Yes, he does.
   _____? The captain's brother.
2. Dick introduced ***his wife*** to the captain.
   _____? Yes, he did.
   _____? His wife.
3. The captain had invited ***Dick and his wife*** to sit at his table.
   _____? Yes, he had.
   _____? Dick and his wife.
4. The passengers were asking ***the porters*** about the baggage.
   _____? Yes, they were.
   _____? The porters.
5. The sailors must obey ***the captain.***
   _____? Yes, they must.
   _____? The captain.

Model: Dick is talking to *the captain.*
Is Dick talking to the captain? Yes, he is.
Who is Dick talking to? The captain.

2.3 Follow the model as you ask two questions.

1. Dick's wife has been writing to ***the children.***
   _____? Yes, she has.
   _____? The children.
2. The captain has introduced them to ***a couple from Brazil.***
   _____? Yes, he has.
   _____? A couple from Brazil.
3. Mrs. Mallory often takes walks with ***Mrs. Silva.***
   _____? Yes, she does.
   _____? Mrs. Silva.
4. The Mallorys are reading about ***Brazilian writers.***
   _____? Yes, they are.
   _____? Brazilian writers.
5. Mr. Silva often gives advice to ***Dick.***
   _____? Yes, he does.
   _____? Dick.

Model: Who is Dick talking to? The captain.
To whom is Dick talking? The captain.

2.4 (For writing only) Follow the model as you make questions with a preposition and *whom*.

1. Who has Dick's wife been writing to?
   _____
2. Who has the captain introduced them to?
   _____
3. Who does Mrs. Mallory often take walks with?
   _____
4. Who are the Mallorys reading about?
   _____
5. Who does Mr. Silva give advice to?
   _____

Wh Questions: *Which* or *What* + Noun

Model: *The hotel they stayed in* was on the beach.
(*the hotel* → *which hotel*)
Which hotel was on the beach? The hotel they stayed in.
They liked *the hotel on the beach.*
(*the hotel* → *which hotel*)
Which hotel did they like? The hotel on the beach.
They stayed in *the hotel on the beach.*
(*the hotel* → *which hotel*)
Which hotel did they stay in? The hotel on the beach.

2.5 Follow the model as you construct questions with *which* + noun.

1. ***The Atlantic Ocean*** is off the east coast of the United States.
(*the Atlantic Ocean* → *which ocean*)
_____? The Atlantic Ocean.
2. A ship going from New York to London must cross ***the Atlantic Ocean.***
(*the Atlantic Ocean* → *which ocean*)
_____? The Atlantic Ocean.
3. The Mallorys are sailing on ***the Atlantic Ocean.***
(*the Atlantic Ocean* → *which ocean*)
_____? The Atlantic Ocean.
4. ***The ship they are on*** often sails to South America.
(*the ship* → *which ship*)
_____? The ship they are on.
5. They had seen ***the ship they were to travel on.***
(*the ship* → *which ship*)
_____? The ship they were to travel on.
6. They had often heard about ***the ship they were to travel on.***
(*the ship* → *which ship*)
_____? The ship they were to travel on.

Model: Which hotel was on the beach?
What hotel was on the beach?

2.6 Using the questions you made in 2.5, replace *which* with *what.*

INTENSIVE QUESTIONING: *Yes-No* Questions

1. Did men have to depend on sails for thousands of years? Yes, they did.
2. Did sailing ships have certain disadvantages? Yes, they did.
3. Were they fast? No, they weren't.
4. Were they slow and clumsy? Yes, they were.
5. Could they carry much cargo? No, they couldn't.
6. Did the cargo ever spoil? _____
7. Was there danger in depending on the wind? _____
8. Was a calm sea dangerous? _____
9. Was a calm sea safe? _____
10. Might a heavy storm tear the sails? _____
11. Were the torn sails useless? _____
12. Were many sailing ships safe in bad weather? _____
13. Were many sailing ships used for passengers after 1900? _____
14. Were sailing ships used for cargo before 1900? _____
15. Was steam power added to wind power at first? _____
16. Did Watt think that steam should be used without sails? _____
17. Did Watt doubt that steam should be used without sails? _____
18. Did coal take up much space on steamships? _____
19. Does the diesel engine use coal as a source of power? _____
20. Does the diesel engine use fuel oil as a source of power? _____
21. Is a new source of power for ships being developed? _____
22. Is the new source atomic energy? _____
23. Do nuclear submarines need oxygen to work? _____
24. Can nuclear submarines stay under water a long time? _____
25. Are nuclear submarines slower than other submarines? _____

Understanding Ideas

1. What are the disadvantages of sailing vessels? (paragraph 1)

2. In what ways are motor ships better than steamships? (paragraph 4)

3. What special advantages do atomically powered submarines have? (paragraph 5)

Applying the Reading

1. Have you ever been in a boat or on a ship? If so, what kind of boat or ship was it? Try to describe it briefly.

2. Does any part of your country touch a sea or an ocean? If so, name it. Are there any large rivers in your country that can be used for navigation? Any large lakes? If so, name them. Are any of your cities important centers of shipping? If so, name them.

3. Does your country export or import products by ship? If so, name some of the products that are imported or exported. If your country does not have shipping, what means of transportation does it use for exporting and importing?

Composition

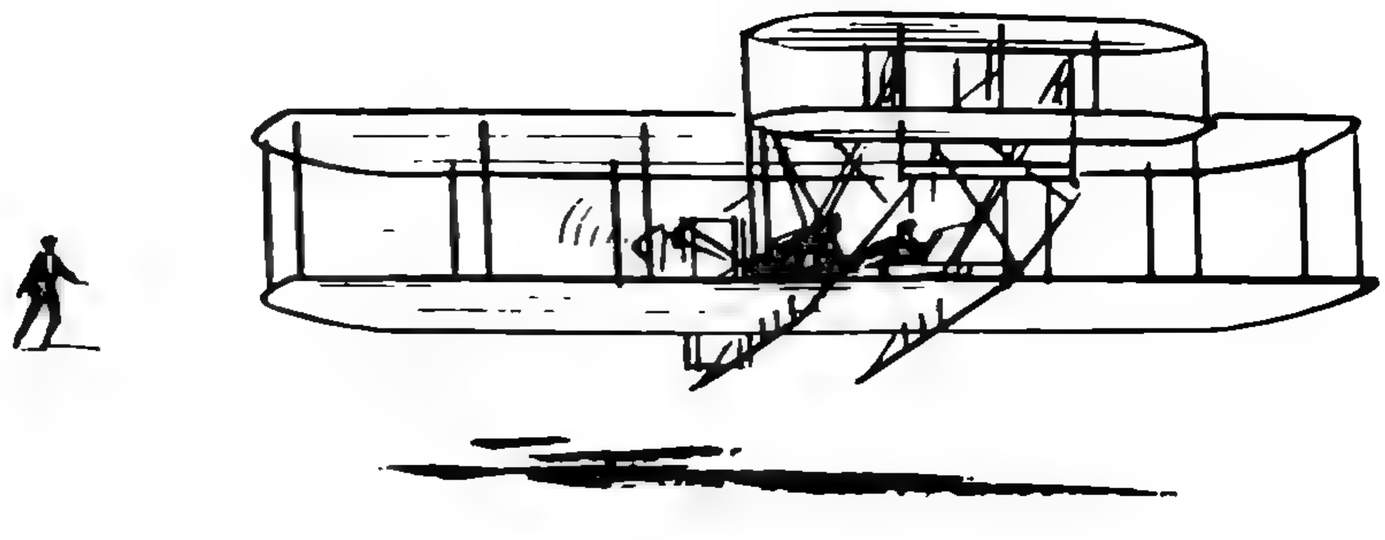
1. Notice that the first paragraph is developed by giving examples of the disadvantages of sailing vessels. Find the topic sentence.

2. Notice that paragraph 6 is developed by using three examples. What are they?

3. Notice that the reading deals with four ways in which ships can be moved. Write a short paragraph in which you describe the development of the ship from sails to atomic power. Begin with one of the following topic sentences: *Since the days of the early sailing ships, three important sources of power have been developed for use in ships.* Or: *In the history of shipping, ships have been propelled in four ways.*

Three: TRANSPORTATION BY AIR: AIRPLANES

From balloons to jet planes



The Wright brothers' flying machine

1] It was December, 1903, in the southeastern United States. Strong winds bent the grass near the beach, and the smell of salt air [1] came in from the Atlantic Ocean. A small group of men were standing near a strange flying machine. One of them, whose name was Wilbur Wright, began to push the machine along a rail, while another—his brother Orville—lay on the lower wing and grasped the simple controls.

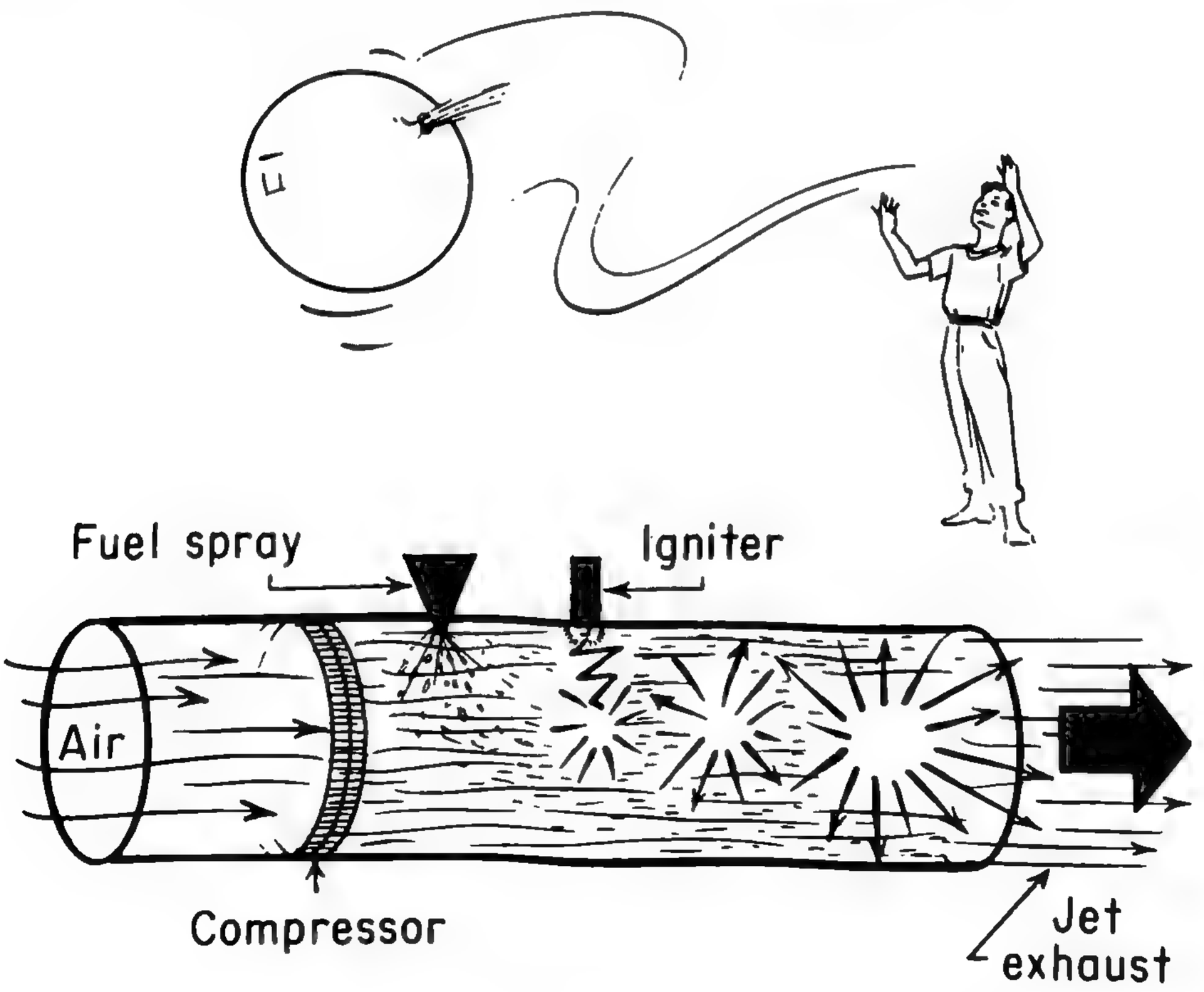
2] Only five persons were there to see the clumsy craft rise from the ground as Wilbur ran faster and faster. After flying only 120 feet, it touched the ground again and slid to a stop. Man had flown his first successful airplane with a gasoline engine.

3] The Wright brothers had made use of the knowledge of many people before them. As early as the fifteenth century an Italian named Leonardo da Vinci had designed machines that he thought would fly. Later, men had experimented with balloons that rose high above the ground. One of them, a Brazilian named Santos-Dumont, had flown a dirigible with a gasoline motor and a propeller near Paris in 1899. That was four years before the Wright brothers' success. Others who had experimented with gliders in the nineteenth century had learned much about designing airplane bodies. Several planes without passengers had been successfully tested in Europe and America. But the Wright brothers made the first successful flight of a heavier-than-air machine that carried a man and flew under [2] its own power.

4] Since the days of the Wright brothers, rapid improvements have been made in the construction and design of airplanes. Planes were built with two, three, and four engines for greater speed. Because of improved navigational systems, flying at night has become routine, and planes can fly safely in fog and rough weather. Now it is possible to fly around the world in comfort and safety.

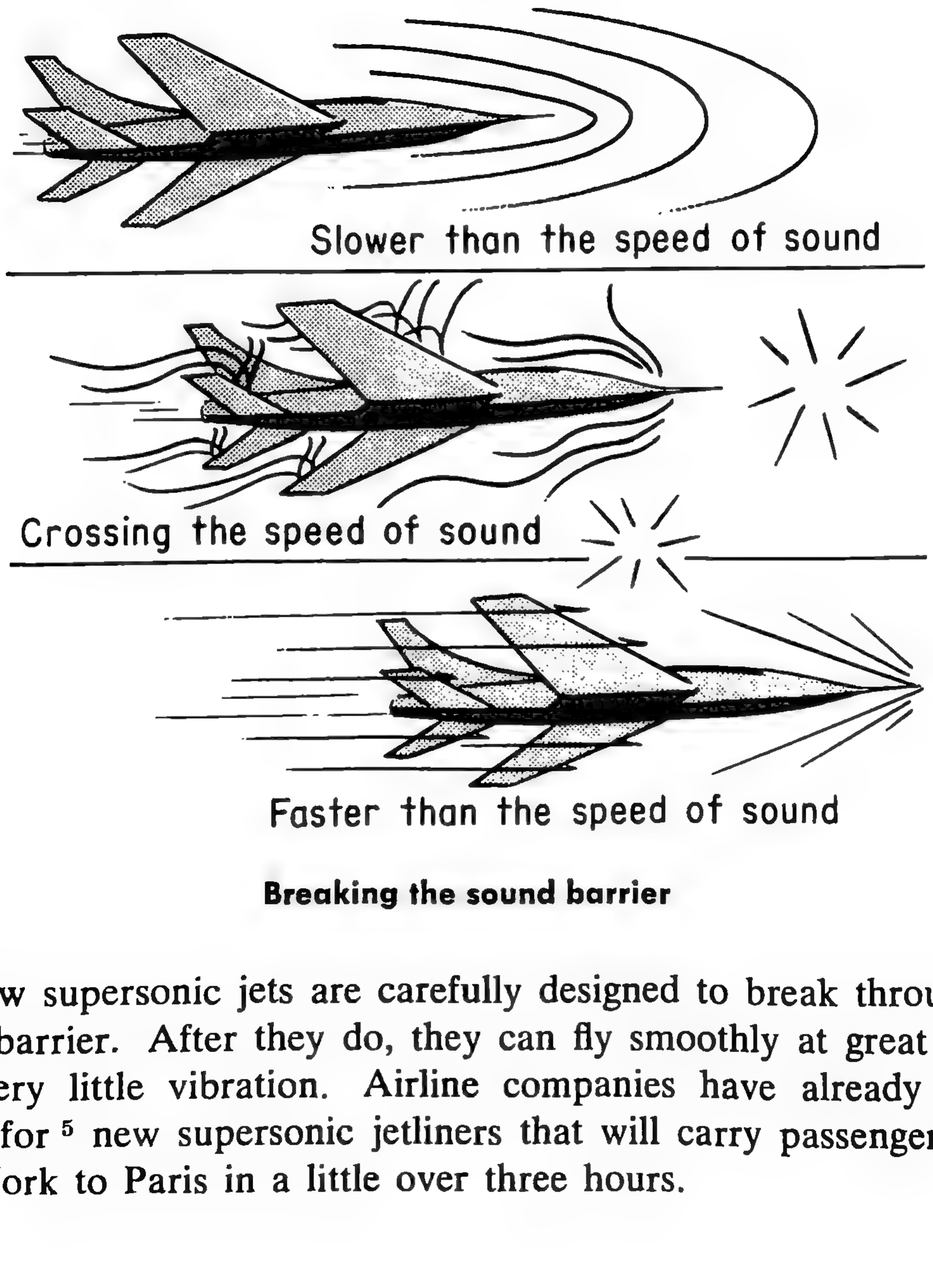
5] Probably the greatest improvement in air transportation has been the jet engine. Jet airplanes usually fly at high altitudes, and they fly very fast.

6] The simplest way to understand how a jet engine works is to watch air escaping from a balloon. As the air escapes, it creates a back pressure that pushes the balloon forward. In a jet engine, as you can see by looking at the picture below, the effect is almost the same. Air rushes through a tube. A spray of gasoline or kerosene is injected into the stream of air, and a series of continuous explosions takes place. As the exploding gas rushes out from the rear of the tube, a back pressure is created that sends the tube forward with great force.



A jet engine

7] As the jet airplane forces its way through the sky, the air is compressed in front of it, causing great pressure. The pressure becomes greater as the plane flies faster. At speeds of about 700 miles an hour—that is, about the speed of sound—an extreme pressure disturbance builds up [3] just ahead of the plane. This disturbance is called a *shock wave*. When a plane passes through this shock wave, we say that it is breaking the *sound barrier*. Persons on the ground can often hear "booms" or "bangs" when a plane crosses the sound barrier and flies faster than sound.[4] Sometimes the sound waves produced by an airplane in supersonic (faster than sound) flight break windows in houses on the ground.



Breaking the sound barrier

8] New supersonic jets are carefully designed to break through the sound barrier. After they do, they can fly smoothly at great speeds with very little vibration. Airline companies have already placed orders for [5] new supersonic jetliners that will carry passengers from New York to Paris in a little over three hours.

GRAMMAR REVIEW: *Wh* Questions: *What*

Model: Dick's secretary got a plane ticket for him.
Did Dick's secretary get a plane ticket for him? Yes, she did.
What did Dick's secretary get for him? A plane ticket.
Dick asked his secretary for the plane ticket.
Did Dick ask his secretary for the plane ticket? Yes, he did.
What did Dick ask his secretary for? The plane ticket.

3.1 Follow the model as you construct questions with *what*.

1. Dick's children saw the new jet at the airport.
   Did _____? Yes, they did.
   What _____? The new jet.
2. Dick's son builds model airplanes.
   Does _____? Yes, he does.
   What _____? Model airplanes.
3. Dick's brother is a pilot.
   Is _____? Yes, he is.
   What _____? A pilot.
4. He has been trained to fly the new jets.
   Has _____? Yes, he has.
   What _____? The new jets.
5. He can explain all the complicated instruments.
   Can _____? Yes, he can.
   What _____? All the complicated instruments.
6. Dick's son has read a lot about modern aviation.
   Has _____? Yes, he has.
   What _____? Modern aviation.
7. He spends hours looking at pictures of the newest planes.
   Does _____? Yes, he does.
   What _____? Pictures of the newest planes.
8. His uncle is helping him with the technical words.
   Is _____? Yes, he is.
   What _____? The technical words.
9. Dick likes to travel in big jets.
   Does _____? Yes, he does.
   What _____? Big jets.

Wh Questions: *Where* and *When*

Model: Dick flew *to San Francisco* last week.
Where did Dick fly last week? To San Francisco.

3.2 Make questions with *where* that have the words in ***boldface*** as answers.

1. The jet landed ***at the new airport.***

_____

2. Jets can fly very efficiently ***at high altitudes.***

_____

3. The jet went ***to Europe.***

_____

4. Tourist-class passengers must board the plane ***at the rear.***

_____

5. The pilot should have stayed ***in the cockpit.***

_____

Model: Dick flew to San Francisco *last* week.
When did Dick fly to San Francisco? Last week.

3.3 Make questions with *when* that have the words in ***boldface*** as answers.

1. Jets were developed ***fairly recently.***

_____

2. The plane was due to arrive ***an hour ago.***

_____

3. ***On his last trip*** the pilot encountered rough weather.

_____

4. The pilot had been warned about the storm ***before he took off.***

_____

5. The passengers will board the plane ***in ten minutes.***

_____

6. The plane should have taken off ***hours ago.***

_____

7. The plane was supposed to land ***about dinnertime.***

_____

Wh Questions: *Why*, *How*, and *Whose*

Model: They went to the airport *to see the new jets.*
Why did they go to the airport? To see the new jets.

3.4 Make questions with *why* that have the words in ***boldface*** as answers.

1. ***Because winter was coming,*** we had foggy weather.
2. The plane had to wait ***because the pilot hadn't come aboard.***
3. The red light went on ***to warn the pilot.***
4. ***Because of the foggy weather*** it is dangerous to fly without radar.
5. They had sent out a helicopter ***to rescue the crew.***

Model: Planes can be guided *by radar* in foggy weather.
How can planes be guided in foggy weather? By radar.

3.5 Make questions with *how* that have the words in ***boldface*** as answers.

1. They went to Australia ***by jet.***
2. Stewardesses serve food ***on trays.***
3. Passengers can call the stewardess ***by pushing a button.***
4. The stewardess greeted the passengers ***cheerfully.***
5. Pilots get landing instructions ***by radio.***

Model: The pilot asked for *Dick's* passport.
Whose passport did the pilot ask for? Dick's.

3.6 Make questions with *whose* that have the words in ***boldface*** as answers.

1. The stewardess spilled ***the old lady's*** coffee.
2. The man at the counter weighed ***the passenger's*** baggage.
3. The pilot needs ***the tower's*** permission to take off.
4. The stewardess listened to ***the old man's*** complaints.
5. The stewardess hung up ***the passengers'*** coats.
6. The pilot believed ***the passenger's*** story.
7. Dick carried ***his wife's*** bags.
8. You need ***the pilot's*** permission to unfasten your seat belt.

INTENSIVE QUESTIONING: *Yes-No* Questions

Refer to the reading as you choose between *yes* and *no* answers.

1. Had the Wright brothers built on the knowledge of others? Yes, they had.
2. Had Da Vinci designed flying machines? _____
3. Had Da Vinci ever flown in his machines? _____
4. Was Da Vinci a Frenchman? _____
5. Did Da Vinci live in the eighteenth century? _____
6. Had men experimented with balloons? _____
7. Was Santos-Dumont a Brazilian? _____
8. Had Santos-Dumont flown in a glider? _____
9. Had Santos-Dumont flown in a dirigible? _____
10. Did the dirigible have a motor? _____
11. Did the dirigible have many propellers? _____
12. Did Santos-Dumont fly near Paris? _____
13. Did Santos-Dumont fly in 1888? _____
14. Had Santos-Dumont flown before the Wright brothers? _____
15. Had others experimented with gliders? _____
16. Had planes with passengers been tested before? _____
17. Did the Wright brothers' machine carry a man? _____
18. Did the Wright brothers' machine fly under its own power? _____
19. Have airplanes been improved rapidly? _____
20. Were planes built with more than one engine? _____
21. Is flying at night rare? _____
22. Has flying at night become routine? _____
23. Can planes fly safely in fog? _____
24. Is it possible to fly around the world? _____
25. Do jets usually fly at low altitudes? _____
26. Do jets usually fly at high altitudes? _____
27. Are jets fast? _____
28. Are jets slow? _____
29. Does air escaping from a balloon create a back pressure? _____
30. Does the pressure push the balloon backward? _____
31. Does the pressure push the balloon forward? _____

INTENSIVE QUESTIONING: *Wh* Questions

Refer to the reading in order to find the correct answers.

1. Whose knowledge had the Wright brothers made use of?
   They had made use of the knowledge of many people before them.
2. Who had designed flying machines in the fifteenth century?

   _____

3. When had Da Vinci designed flying machines?

   _____

4. What country did Da Vinci live in?

   _____

5. Who had flown a dirigible in 1899?

   _____

6. When had Santos-Dumont flown?

   _____

7. Where had Santos-Dumont flown?

   _____

8. What had Santos-Dumont flown in?

   _____

9. What kind of motor did the dirigible have?

   _____

10. What did the dirigible have besides a motor?

    _____

11. How many years before the Wright brothers' flight did Santos-Dumont's flight take place?

    _____

12. When had others experimented in gliders?

    _____

13. What had those who had experimented in gliders learned about?

    _____

14. What planes had been tested before the Wright brothers' flight?

    _____

15. Where had planes without passengers been successfully tested?

    _____

16. Why are the Wright brothers famous?

    _____

17. How many passengers did their plane carry?

    _____

Understanding Ideas

1. What knowledge had the Wright brothers built on? (paragraph 3)

2. How did the flight of the Wright brothers differ from earlier flights that had been made? (paragraph 3)

Applying the Reading

1. Try to describe an airport you know and some of the planes you have seen. How many engines did they have? Were they jet planes or propeller planes?

2. What are the main cities in your country that can be reached by plane? Can they be reached in any other way—by bus, by train, or by ship? Compare the time taken to travel between two well-known cities if you (1) go by plane and (2) go by some other means of transportation.

Composition

1. Notice that paragraph 6 is developed by comparing a simple process with a more complicated one. Pick out the sentence which relates the balloon to the jet engine.

2. Notice that the explanation of the jet engine in paragraph 6 refers the reader to a picture. Study the explanation carefully in connection with this picture. Then see if you can write approximately the same paragraph by referring to the picture alone. Begin with this topic sentence: *A jet engine acts very much like a balloon from which air is escaping.*

3. How would you describe the sound barrier if a friend of yours asked you what it was? You can use paragraph 7 as a model, but you should try to expand the explanation and use some of your own sentences. Your teacher will help you with any extra words you need.

Four: TRAVEL IN SPACE: ROCKETS

To the moon and beyond

A rocket engine

1] The rocket engine, with its steady roar like that of a waterfall or a thunderstorm, is an impressive symbol of the new space age.[1] But impressive and complex as it may appear, the rocket, which was invented in China over 800 years ago, is a relatively simple device.

2] Fuel that is burned in the rocket engine changes into gas. The hot and rapidly expanding gas must escape, but it can do so only through an opening that faces backward. As the gas is ejected with great force, it pushes the rocket in the opposite direction. Like the kick of a gun [2] when it is fired, it follows the law of nature described by Sir Isaac Newton when he discovered that "for every action, there is an equal and opposite reaction."

3] Rockets are now being made that are powerful enough to shoot a man [3] beyond the earth's gravitational pull. In such a rocket a man could be sent into space accurately enough to arrive at the moon. He could even land there gently and not be killed in a crash. With supplies of air and food, he could live on the moon for weeks or even months.

4] Why does man want to go to the moon? Just for adventure? True, there is adventure in space travel. But a trip to the moon would also be practical. For example, space stations could be built that would give us valuable information about the weather. In space stations revolving around the earth, men could live and study the cloud formations on its surface. These formations could tell us what weather to expect in any part of the world at any time. Such information would be very useful to pilots, to ship captains, and even to farmers who must set dates for planting and harvesting.

5] There are many problems connected with space travel. The first and greatest of them is gravity. If you let your pencil drop to the floor, you can see gravity in action. Everything is held down to the earth by magnetic force. The weight of something is another way of describing the amount of force exerted on it by gravity. A rocket must go [4] at least 2,500 miles an hour to take a man beyond the gravity of the earth into space.

6] Another problem is the strain that a man is subjected to when a rocket leaves the ground. Anything that is not moving tends to resist movement. As the rocket leaves the ground, it pushes upward violently, and the man in the nose cone [5] is pushed back against his chair. During this thrust gravity exerts a force on his body equal to nine times its normal force.

7] Once he is out of the earth's gravity, a spaceman is affected by still another problem—weightlessness. Here, if he lets go of a pencil, it does not fall. A glass of water can be turned upside down and the water will not fall out. All of us who are used to gravity expect things to have weight and to fall when dropped. Our bodies, which are accustomed to gravity, would become upset in weightless conditions.

8] Spacemen could also be affected by boredom and loneliness. Some of them might have to sit in their spaceships for months with little to do and no one to talk to. Space trips to distant planets or the nearest stars might take many years. It is possible that some trips might even take a lifetime. So future spacemen must be trained to endure long periods of inactivity and solitude.

9] Cosmic rays and tiny dust particles are another problem. Outer space,[6] which has no air, is filled with both of these.[7] The dust particles can damage the front end of the rapidly moving spaceship. The cosmic rays, though they are invisible to the naked eye, can go through the ship and the spaceman himself. No one is sure what damage the cosmic rays can do to a man, but scientists feel that brief exposure is probably not very harmful.

10] The intense heat caused by friction is also a problem in space travel. If you rub your hand hard on your forehead, you will feel this kind of heat. Once a spaceship is in outer space, there is no friction because there is no air to press against. But when the spaceship returns to earth, it must go through air again. At first the air is very thin. But the closer the ship comes to earth, the denser the air it meets. A spaceship entering the earth's atmosphere at full speed would get so hot that it would burn up and completely disappear.

11] Today scientists are working harder than ever to solve these problems of space travel. Someday they are going to discover a powerful fuel for rockets that will send men through space at the speed of light. So much progress is being made that there may be space flights to Mars and other planets within your own lifetime.

Reaching for the moon, the first target

GRAMMAR REVIEW: Conjunction: *And, But, Or,* and *For*

Model: Spacemen will land on the moon. They will send back reports.
Spacemen will land on the moon, and they will send back reports.
Space travel was dangerous. Now it is safe.
Space travel was dangerous, but now it is safe.
The spaceman must have oxygen. He will die.
The spaceman must have oxygen, or he will die.
The spaceman couldn't send a signal. His radio didn't work.
The spaceman couldn't send a signal, for his radio didn't work.

4.1 Combine the following sentences with *and, but, or,* or *for.*

1. Planes were small. Flying was unsafe.
   _____, and _____
2. Some men have wondered about the moon. Some have even wanted to go there.
   _____, and _____
3. The plane has landed. The engines haven't been turned off.
   _____, but _____
4. The spaceman landed safely. The spaceship was destroyed.
   _____, but _____
5. His food has run out. He has a supply of water.
   _____, but _____
6. We had to fasten our seat belts. We would have bumped our heads.
   _____, or _____
7. The runways had to be lengthened. Jet planes couldn't land.
   _____, or _____
8. Pilots must know about the weather. They can't take off.
   _____, or _____
9. The townspeople didn't like the jets. They made too much noise.
   _____, for _____
10. Space travel is practical. It can help us forecast the weather.
    _____, for _____
11. Farmers sometimes use planes. Planes can be used to spray insects.
    _____, for _____

Conjunction and Deletion: *So* and *Too*

Model: Dick likes to read about rockets. His children like to read about rockets.
He likes to read about rockets, and so do his children.
He likes to read about rockets, and his children do, too.

4.2 Combine each pair of sentences with *and*. First use *so* to shorten the second sentence and then use *too*.

1. The space craft was destroyed. Its instruments were destroyed.

2. The pilot is safe. The passengers are safe.

3. The pilot warned us. The stewardess warned us.

4. The pilot has come aboard. The copilot has come aboard.

5. The number one engine had stopped. The number four engine had stopped.

6. A train would be too slow. A bus would be too slow.

7. The morning plane will be late. The afternoon plane will be late.

8. The earth has gravity. Other planets have gravity.

9. I might be a pilot. My brother might be a pilot.

Conjunction and Deletion: *Either* and *Neither*

Model: I don't know much about rockets. You don't know much about rockets.
I don't know much about rockets, and you don't either.
I don't know much about rockets, and neither do you.

4.3 Combine each pair of sentences with *and*. First use *either* to shorten the second sentence and then use *neither*.

1. My family doesn't fly much. I don't fly much.

_____

_____

2. The pilot didn't talk to the passengers. The stewardess didn't talk to the passengers.

_____

_____

3. Those buses aren't going to the airport. Those taxis aren't going to the airport.

_____

_____

4. The time of arrival hasn't been announced. The time of departure hasn't been announced.

_____

_____

5. The engine hadn't been repaired. The wing hadn't been repaired.

_____

_____

6. The passengers can't board the plane. The crew can't board the plane.

_____

_____

7. You won't have a seat by the window. I won't have a seat by the window.

_____

_____

8. Our new airport isn't large. Our old airport wasn't large.

_____

_____

INTENSIVE QUESTIONING: *Yes-No* Questions

Refer to the reading as you choose between *yes* and *no* answers.

1. Is outer space filled with cosmic rays? Yes, it is.
2. Is outer space filled with dust particles? _____
3. Does outer space have air? _____
4. Can dust damage spaceships? _____
5. Are cosmic rays visible to the naked eye? _____
6. Can cosmic rays go through spaceships? _____
7. Is brief exposure to them harmful? _____
8. Can friction cause intense heat? _____
9. Is intense heat a problem in space travel? _____
10. Is there friction in outer space? _____
11. Must a spaceship go through air when it returns to earth? _____
12. Is the air at first very thin? _____
13. Is the air thinner as the ship comes closer to earth? _____
14. Is the air denser as the ship comes closer to earth? _____
15. Can a spaceship safely enter the earth's atmosphere at full speed? _____
16. Would a spaceship burn up if it entered the earth's atmosphere at full speed? _____

INTENSIVE QUESTIONING: *Or* Questions

1. Are dust particles harmless or harmful?
   Dust particles are harmful.
2. Are cosmic rays visible or invisible to the naked eye?

   _____
3. Can cosmic rays go through the ship, or are they stopped by it?

   _____
4. Is intense heat caused by friction or weightlessness?

   _____
5. Is the air near the earth dense or thin?

   _____
6. Must a spaceship enter the earth's atmosphere at full speed or at reduced speed?

   _____

INTENSIVE QUESTIONING: *Wh* Questions

Refer to the reading in order to find the correct answers.

1. What can damage the front end of a spaceship?
   Dust particles. Dust particles can.
2. What can cosmic rays do?

   _____
3. What can cosmic rays go through?

   _____
4. How harmful is a brief exposure to cosmic rays?

   _____
5. What does friction cause?

   _____
6. What can you do to feel friction?

   _____
7. Why is there no friction in outer space?

   _____
8. Where is there no air?

   _____
9. When must the spaceship go through air again?

   _____
10. What must the spaceship go through when it returns to earth?

    _____
11. What is the air like at first?

    _____
12. What is the air like closer to earth?

    _____
13. Why doesn't the spaceship enter the earth's atmosphere at full speed?

    _____
14. How hot would it get if it did?

    _____
15. What problems are scientists working hard to solve?

    _____
16. What kind of fuel will scientists discover some day?

    _____
17. Where may space flights take place within your lifetime?

    _____

Understanding Ideas

1. How could a space station give information about the weather? Why would such information be valuable? (paragraph 4)

2. How is gravity related to weight? What is weightlessness? (paragraphs 5 and 7)

3. Why is friction a problem in space travel? (paragraph 10)

Applying the Reading

1. Do you have hurricanes or monsoons in your country? Do you have quick changes in the weather? How would a space station that relayed information about the weather be useful to your farmers? To your pilots? To you personally—in planning picnics and holidays, for example?

2. If you were to travel in space, what equipment and supplies would you need to bring with you? What would you like to bring with you?

Composition

1. Notice that the first sentence of paragraph 5 states the subject of paragraphs 5 through 10: *There are many problems connected with space travel.* How many problems are mentioned in the paragraphs that follow? In complete sentences, list these problems in the same order as in the reading.

2. Notice how this phrase in the second sentence of paragraph 5 introduces the first problem: *The first and greatest of them . . .* What other phrases are used to make clear the shift from one problem to another? Find each of them and write them down. These phrases are called *transitional phrases.*

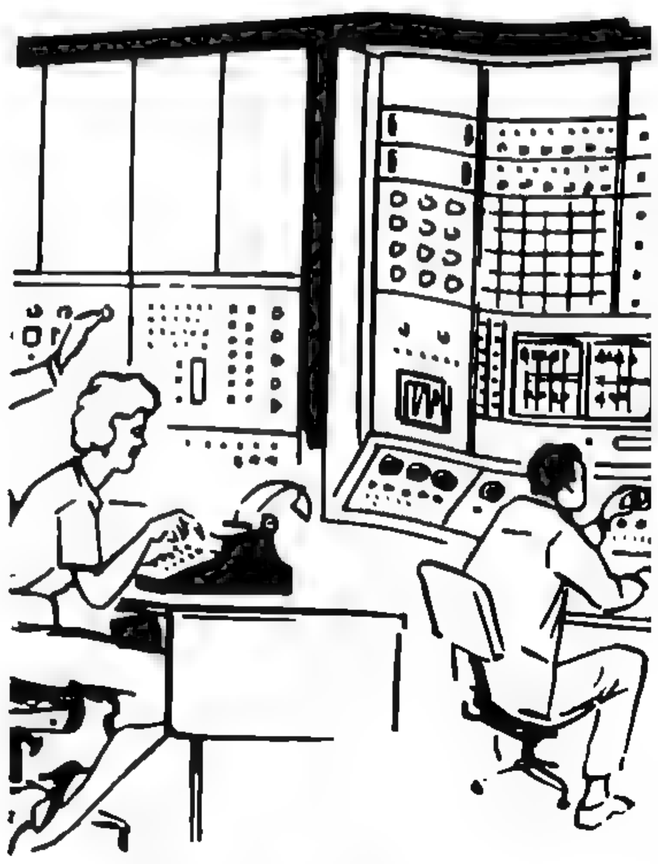
3. Write a single paragraph in which you summarize the problems connected with space travel. Begin your paragraph with the same topic sentence that is used in the reading—that is, the first sentence of paragraph 5.

Unit 2: MACHINES

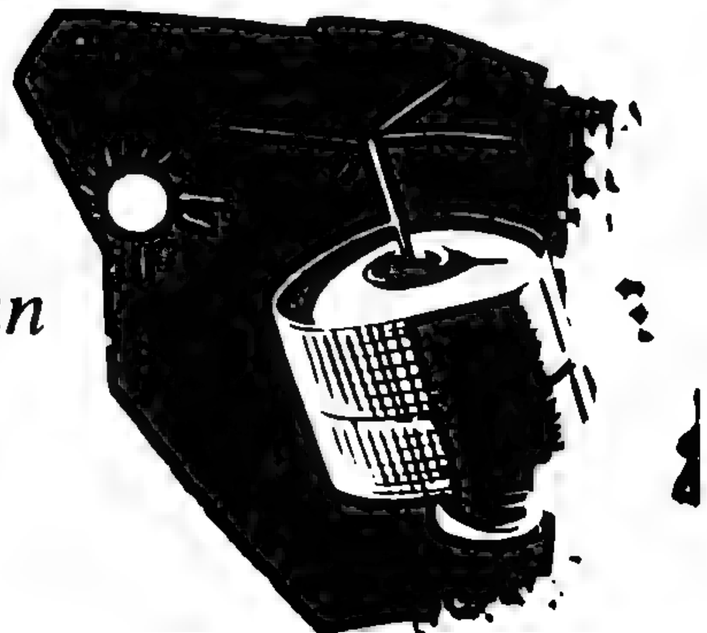
Machines in the life of a city man

Machines in the life of a farmer

The marvel of the machine age, the computer



A new source of power for machines, the sun



Five: A CITY MAN IN THE MACHINE AGE

Dick Mallory lives in a world of machines.

1] Dick Mallory is a book publisher. His office on the fortieth floor of a skyscraper in the center of New York City is the world he works in. The world he lives in is a white house on a quiet street in a suburb 30 miles from the big city. Whether he is at work in the heart of [1] the big city or at home in the quiet suburb, Dick's life is tied to machines. In many ways he represents modern man in the big city—modern man in the machine age.[2]

2] In a typical working day, Dick is awakened by the buzzing of an electric alarm clock. As he pushes a button to silence the alarm, he turns on the radio beside his bed to hear the morning news. Then he goes to the bathroom for a quick shave with his electric shaver.

3] After dressing, Dick goes to the kitchen, where his wife has begun to prepare breakfast. Eggs are cooking on the electric stove, bread is being toasted in an electric toaster, and coffee is being made in an electric coffee maker. From the electric refrigerator Dick takes a carton of cream, another of fresh milk, and a can of orange juice. He opens the can with an electric can opener, mixes the contents with several cans of cold water, and the orange juice is ready.

4] As soon as breakfast is finished, Dick gets the car out of the garage and his wife drives him to the railroad station. The station is crowded with other commuters like himself, men who must travel 30 or even 50 miles to the city and back every day. Some are reading the morning paper; others are talking with one another, waiting nervously for the train. If the train is late, their routine, timed to the minute, could easily be upset. But exactly on schedule, the train arrives at the station. Forty-five minutes later it arrives in the city, still on schedule.

5] With the other commuters, Dick hurries from the train into the station. As he nears the door, it is whipped open by an electric eye, and he passes through into the waiting room. A moment later he steps onto a moving stairway that takes him swiftly up to the street level. Buses and taxis are everywhere, but Dick always walks to his office, only four blocks away.

6] Soon he is inside the sixty-story skyscraper where his company has offices. At a long bank of elevators he waits until a green light flashes for an up car,[3] then steps inside. He pushes the button for the fortieth floor, the door closes, and the car rises smoothly and noiselessly.

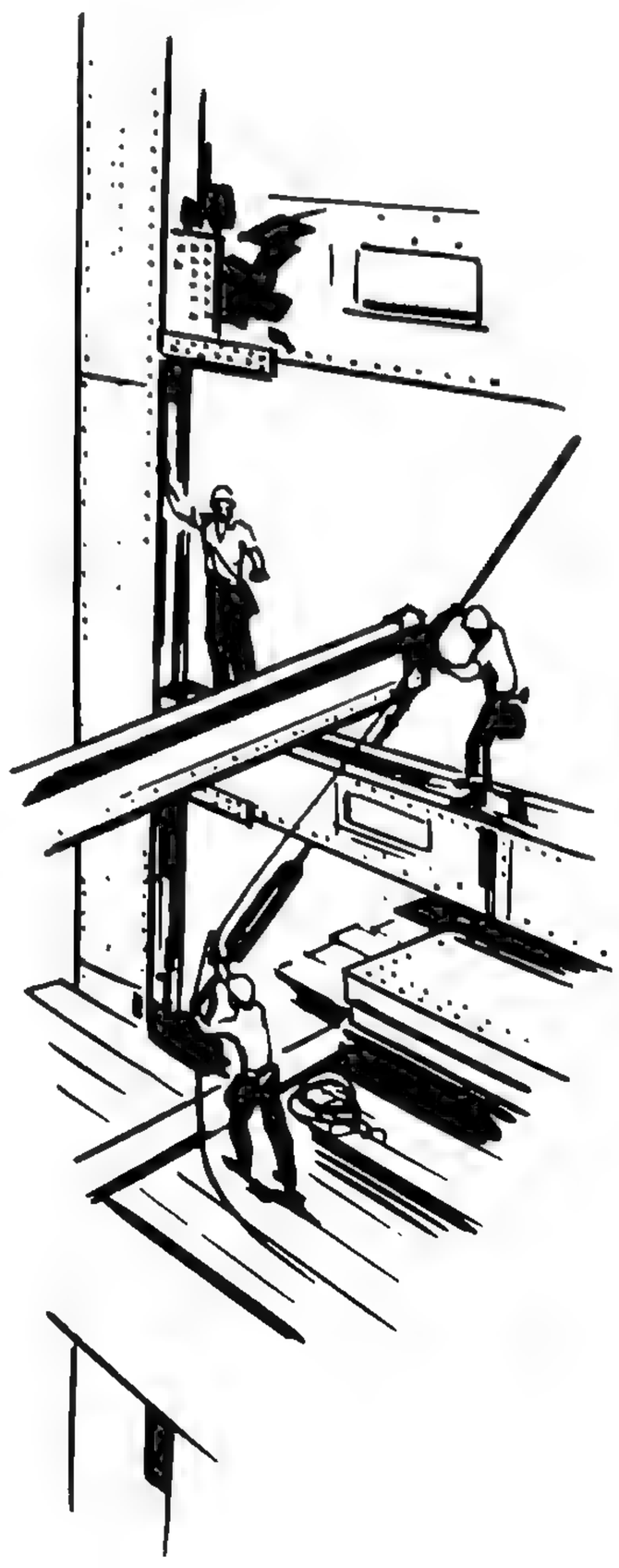
7] When the light flashes for the fortieth floor, the door again slides open, and Dick steps from the elevator into the familiar hall with its soft lights and early-morning quiet, and hurries to his office. He turns on the lights and is soon at work. There is much to be done before the clerks and secretaries begin to arrive.

8] An hour later the day's routine begins with the arrival of the mail. As he reads it, he takes notes, and on the more urgent points picks up the telephone and calls other departments in the building and other businesses in New York. It is a matter of routine for Dick to call the company's offices in Chicago and San Francisco, and sometimes even to call its representatives in London and Paris. Once he has the information he needs, he dictates letters into a recording machine for his secretary to type and return later.

9] At times Dick is aware of the workers in the outer office answering telephones, typing letters, and filing papers. From a room next door he hears the even clicking of a machine that is duplicating copies of schedules and instruction sheets. Other machines are taking pictures of important letters and documents, and producing many copies in a few minutes.

10] From a special office nearby comes the soft hum of a new computer, which is recording orders, billing customers,[4] and making out the company payroll. From time to time the hum is shattered by an automatic typewriter putting on paper the facts produced by the computer.

11] Sometimes Dick is also aware of other sounds—the more or less muffled traffic noises that come from the street down below—the honking of horns, the blowing of whistles, the screeching of brakes. These are curiously mixed with the clang of hammers and riveting machines and the shouts of the workmen putting up a new skyscraper next door. But Dick is used to noise, for the big city, a city of machines, must be a city of noise.



12] Although he is used to the noise, Dick still looks forward to [5] the end of the day when he can return to his house in the quiet suburb. For relaxation he may mow the lawn with his new power mower, or repair a piece of furniture with his electric tools. He may help his young son build a pen for his pet rabbit. Or he may just sit in a comfortable chair watching television or listening to his favorite music on the record player.

13] In the office or at home, machines are a part of Dick Mallory's life. Like many another city man, he would find it hard to live without them.

INTENSIVE QUESTIONING: *Yes-No* Questions

1. Is Dick a book publisher? Yes, he is.
2. Is his office on the thirtieth floor? _____
3. Is his office in a skyscraper? _____
4. Is the skyscraper in Chicago? _____
5. Is the skyscraper in New York? _____
6. Does Dick live in a suburb? _____
7. Does he live in a red house? _____
8. Is the house on a noisy street? _____
9. Is the suburb a mile from the city? _____
10. Is Dick's life tied to machines? _____
11. Is Dick awakened by the paper boy? _____
12. Does he turn on the radio after he wakes up? _____
13. Does he listen to the morning news? _____
14. Is the radio beside his bed? _____
15. Is the radio in the kitchen? _____
16. Does he use an electric shaver? _____
17. Has Dick's wife begun to prepare breakfast? _____
18. Are eggs cooking on a gas stove? _____

INTENSIVE QUESTIONING: *Or* Questions

1. Is Dick a salesman or a book publisher?
   He's a book publisher. He isn't a salesman.
2. Is his office on the thirtieth floor or the fortieth floor?

_____

3. Is his office in a tall building or a low building?

_____

4. Is it in New York City or Chicago?

_____

5. Does Dick live in a white house or a red house?

_____

6. Does Dick live in the city or in a suburb?

_____

7. Is the city quiet or noisy?

_____

8. Is the suburb quiet or noisy?

_____

INTENSIVE QUESTIONING: *Wh* Questions

1. What is Dick Mallory?
   He's a book publisher.
2. What does Dick do?
   He's a book publisher.
3. Where does he work?

4. What floor is his office on?

5. What kind of building is his office in?

6. Where is the skyscraper?

7. Where does Dick live?

8. What color is the house?

9. How far is the suburb from the city?

10. How many miles is the suburb from the city?

11. What does Dick represent?

12. How is Dick awakened?

13. What wakes Dick up?

14. How does he silence the alarm?

15. What does he turn on after he wakes up?

16. Why does he turn on the radio?

17. What does he shave with?

18. Where does he go after dressing?

19. Who is in the kitchen?

Understanding Ideas

1. What machines does Dick use at home? What machines does he use at work?
2. What sounds and noises does Dick hear while he is in the office?
3. What is a commuter? How much time does Dick spend on a train every working day?

Applying the Reading

1. If the electrical power were suddenly cut off in Dick's city, how would his day be different? For example, he might have to walk up to his office on the fortieth floor.
2. How many machines do you depend on during a typical school day? Does anyone in your family use machines that you do not ordinarily make use of?
3. What machines are used routinely in your school or office? If you could buy more machines, which ones do you think would be most useful?

Composition

1. Notice that the entire reading is organized according to a time sequence: it takes Dick Mallory through a typical working day. Go through the reading and pick out phrases (for example, *is awakened* and *after dressing*) that make this time sequence clear.
2. Pick out a sentence, or write a sentence of your own, that summarizes the content of each paragraph. For example, paragraph 1 could be summarized in this sentence: *Dick's life is tied to machines.* Paragraph 2 could be summarized like this: *The first thing in the morning, Dick uses three machines: an alarm clock, a radio, and an electric shaver.*
3. Use the sentences you have just written as guides in preparing a two-paragraph summary of the entire reading. One paragraph would have the following central idea: *In his business Dick uses a variety of machines.* The other paragraph would have a central idea that could be phrased like this: *In his home Dick is also surrounded by machines.*

GRAMMAR REVIEW: Contradiction

Model: Dick can walk to work.
Dick can*not* walk to work.
Dick has lived in the suburbs all his life.
Dick has *not* lived in the suburbs all his life.
Dick is living in New York now.
Dick is *not* living in New York now.

5.1 Follow the model as you contradict the following statements. Remember to give heavy stress to *not*.

1. Dick was born in the suburbs.

_____

2. His children were born in New York.

_____

3. Dick is an architect.

_____

4. Dick will walk home after work.

_____

5. Dick could afford to take a taxi to work every day.

_____

6. Dick could do without a telephone.

_____

7. Dick should stop when the traffic light is green.

_____

8. Dick has been driving to work every day.

_____

9. The Mallorys have lived in the suburbs all their lives.

_____

10. Dick had wanted his children to live in an apartment.

_____

Model: Dick *can't* walk to work.
Dick *hasn't* lived in the suburbs all his life.
Dick *isn't* living in New York now.

5.2 Follow the model as you contradict the statements in 5.1. Use contractions with *n't*.

Model: Dick lives in New York.
Dick does *not* live in New York.
Dick lived in the suburbs when he was a boy.
Dick did *not* live in the suburbs when he was a boy.
Dick and his wife want to live in New York.
Dick and his wife do *not* want to live in New York.

5.3 Follow the model as you contradict the following statements. Remember to give heavy stress to *not*.

1. Dick walks to work.

_____

2. Dick's train always arrives on time.

_____

3. Dick walked up to his office on the fortieth floor.

_____

4. Dick's children go to school by train.

_____

5. His children walk to school.

_____

6. Dick's parents live in the suburbs.

_____

7. Dick drives to work most of the time.

_____

8. Dick's secretary arrives at the office before he does.

_____

9. She left before she finished typing the letters.

_____

10. She wrote the letters by hand.

_____

11. The Mallorys moved to an apartment.

_____

Model: Dick *doesn't* live in New York.
Dick *didn't* live in the suburbs when he was a boy.
Dick and his wife *don't* want to live in New York.

5.4 Follow the model as you contradict the statements in 5.3. Use contractions with *n't*.

Insistence

Model: Dick's wife can't drive.
Dick's wife *can* drive.

5.5 Follow the model as you insist that the following statements are true. Remember to give heavy stress to the auxiliary.

1. Dick's secretary can't type.

_____

2. Dick couldn't walk from the station to his office.

_____

3. Dick isn't a book publisher.

_____

4. Dick hasn't become accustomed to commuting.

_____

5. The Mallorys hadn't lived in New York.

_____

Model: Dick's wife doesn't drive the car.
Dick's wife *does* drive the car.
The Mallorys don't own a car.
The Mallorys *do* own a car.
Dick's wife didn't drive him to the station.
Dick's wife *did* drive him to the station.

5.6 Follow the model as you insist that the following statements are true. Remember to give heavy stress to *do*, *does*, or *did*.

1. Skyscrapers don't need elevators.

_____

2. Dick doesn't have a secretary.

_____

3. Dick didn't take the train to work.

_____

4. His children don't take a bus to school.

_____

5. Dick doesn't make long-distance calls.

_____

Clauses with *When*

Model: Dick wakes up then.
The alarm clock goes off then.
. . . when the alarm clock goes off.
Dick wakes up when the alarm clock goes off.
When the alarm clock goes off, Dick wakes up.

5.7 Follow the model as you construct two sentences with *when*.

1. Dick turns on the radio then.
He wakes up then.
. . . when _____
Dick _____
When _____
2. Dick goes to the bathroom to shave then.
He gets out of bed then.
. . . when _____
Dick _____
When _____
3. Dick goes to the kitchen for breakfast then.
He gets dressed then.
. . . when _____
Dick _____
When _____
4. Dick's wife pours him a cup of coffee then.
He sits down at the table then.
. . . when _____
Dick's wife _____
When _____
5. Dick gets the car out of the garage then.
He finishes breakfast then.
. . . when _____
Dick _____
When _____
6. Dick's wife drives him to the station then.
He is ready then.
. . . when _____
Dick's wife _____
When _____

Clauses with *While*

Model: Dick gets dressed during that time.
His wife prepares breakfast during that time.
. . . while his wife prepares breakfast.
Dick gets dressed while his wife prepares breakfast.
While his wife prepares breakfast, Dick gets dressed.

5.8 Follow the model as you construct two sentences with *while*.

1. Dick thinks about the day's work during that time.
He is drinking his coffee during that time.
. . . while _____
Dick _____
While _____
2. Dick reads the morning paper during that time.
He is riding to work during that time.
. . . while _____
Dick _____
While _____
3. Dick wrote notes during that time.
He was talking on the telephone during that time.
. . . while _____
Dick _____
While _____
4. Dick's wife telephoned during that time.
He was out to lunch during that time.
. . . while _____
Dick's wife _____
While _____
5. Dick watched television during that time.
He was waiting for dinner during that time.
. . . while _____
Dick _____
While _____
6. Dick smoked his pipe during that time.
He was mowing the lawn during that time.
. . . while _____
Dick _____
While _____

5.9 Use the verb in the first sentence to guide your choice between *when* and *while*. Use *while* with verbs if you can say *during that time*. Use *when* with verbs if you can say *at that time*. Situation: One day Dick drove his car to work.

1. he came to the traffic light near his house/it was red

   _____

2. he saw the red light/he stopped the car

   _____

3. he was waiting for the light to change/he turned on the radio

   _____

4. he was driving to work/he listened to the news on the radio

   _____

5. he drove past the corner near his office building/he turned into a parking lot

   _____

6. he found a parking space/he parked his car and locked it

   _____

7. he was walking to his office/he remembered that he had left his briefcase in his car

   _____

8. he got back to the car/he couldn't find his keys

   _____

9. he was wondering what to do/a small boy brought him the keys

   _____

10. he offered the boy some money/the boy wouldn't take it

    _____

11. he got to the office/his secretary had already arrived

    _____

12. he read the mail/he wrote notes on important points

    _____

13. he finished the mail/he called his secretary

    _____

14. he was at lunch/his secretary typed his dictation

    _____

15. he got back from lunch/his letters were done

    _____

16. he was signing his letters/the telephone rang

    _____

Clauses with *Before*, *After*, *Until*, and *Since*

Model: Dick used a razor before that time.
He bought an electric shaver.
Dick used a razor before he bought an electric shaver.

5.10 Combine the sentences by using one of the following words: *before, after, until,* or *since.*

1. Dick got the car out of the garage after that time.
He finished breakfast.

_____

2. He hadn't looked at the morning paper until that time.
He got on the train.

_____

3. He had been reading the paper since that time.
He got on the train.

_____

4. He began to work before that time.
His secretary arrived.

_____

5. The secretary stayed in the office until that time.
She had typed all the letters.

_____

6. Dick's train left before that time.
He got to the station.

_____

7. His wife called him after that time.
He had left the office.

_____

8. The telephone has been ringing since that time.
He left the office.

_____

9. Dick mows the lawn after that time.
He finishes dinner.

_____

10. Dick listens to the news before that time.
He goes to bed.

_____

Clauses with *Because* and *Since*

Model: Dick lives in a suburb for this reason. He thinks it's quiet.
Dick lives in a suburb because he thinks it's quiet.
Because he thinks it's quiet, Dick lives in a suburb.

5.11 Follow the model as you write sentences with *because* clauses.

1. He uses an electric shaver for this reason. He gets a faster shave.

_____

_____

2. He turns on the radio for this reason. He wants to hear the news.

_____

_____

3. He uses an electric can opener for this reason. It opens cans more easily.

_____

_____

4. Dick's wife shops at the new supermarket for this reason. It's near their house.

_____

_____

5. Dick's family uses frozen orange juice for this reason. It costs less than fresh orange juice.

_____

_____

Model: Because the highways are crowded, Dick takes the train to work.
Since the highways are crowded, Dick takes the train to work.

5.12 Use the following table to make sentences with *since* and *because*.

Because Since	the highways are crowded there is no parking space gas is expensive the traffic is heavy	Dick takes the train to work. Dick doesn't drive to work. Dick leaves his car at home. some commuters prefer trains.

Six: A FARMER IN THE MACHINE AGE

Life on the farm has changed with the introduction of machinery.

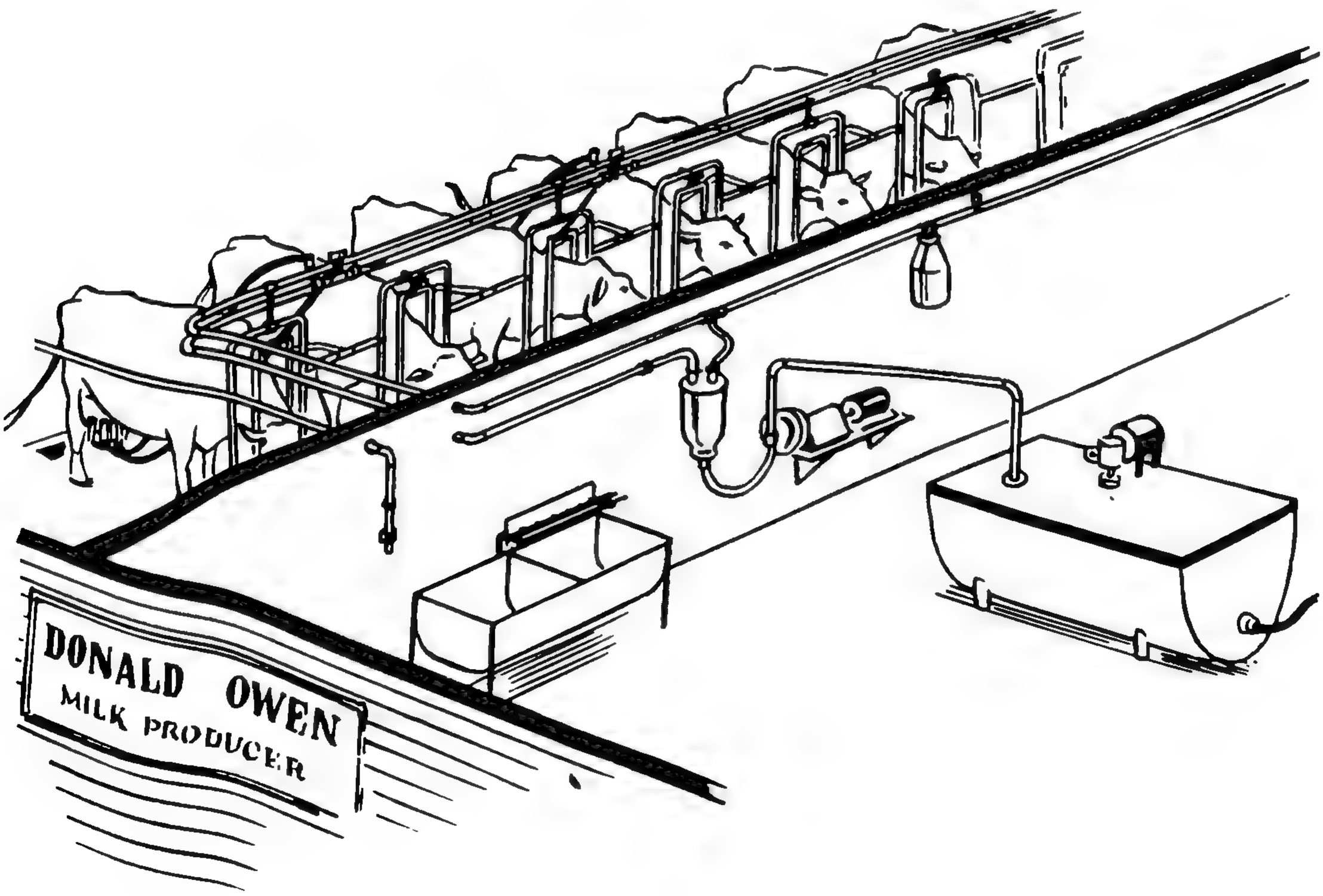
1] On the old-time farm in America there were chickens and turkeys. There were also cows, pigs, and other livestock. But there were very few machines. Most of the work was done by the farmer, his wife, and his children, with the help of a "hired man." Sometimes extra men were needed in busy seasons. Horses provided 79 percent of the power used, human labor 15 percent, and machines only 6 percent.

2] Today all that has changed. On many modern farms machines now furnish 96 percent of the power, human labor 3 percent, and horses 1 percent. The modern farmer is an enterprising businessman who keeps only the livestock that can pay its way.[1] The farmer's children go to school by bus every morning, the farmer's wife works mostly in the house, and hired help is seldom needed. Their work has been replaced by a whole army of farm machines.

3] A farmer in the machine age also uses the new fertilizers, new sprays, new feeds, new hybrid seeds, and other helps from farm sciences. As a result he is able to produce more food with less labor. This means fewer but larger farms, and fewer but more prosperous farmers.

4] Let's take a look at a typical mechanized farm—the 150 acres owned by Don and Betty Owen in northern Michigan. Life on the Owens' farm is very different from farm life as many city people might imagine it. Good roads and an automobile mean that they can get to town, do their shopping, and be back home in a short time. If they buy in quantity, the surplus food can be stored in a home freezer. They keep in touch with [2] the news by radio, newspaper, and television. With the telephone they can call their neighbors and friends whenever they like.

5] Don's dairy farm is one of the finest to be found anywhere. He milks about fifty cows with only part-time help to get the milking machines on and off the cows and to care for the milk afterward. A pipeline carries the milk from milking machines to a cooling tank. Don's herd is kept in a large feedlot where there is an automatic feeder that fills itself from a silo. This feeder saves Don hours every day.



Milking machines

6] Betty's kitchen is just as modern as Don's barn. She uses electric power for cooking, for storing food, and for pasteurizing milk. And her kitchen is constantly being improved so that Betty can do her work faster. If she saves time in her kitchen, she can help with other work on the farm.

7] For the Owens' children, modern farm life is very different from the life their parents knew. The one-room schoolhouse their parents walked to was closed down fifteen years ago. Today a big yellow bus picks the children up and takes them to a large consolidated school miles away. While they still have trees to climb and animals to play with, they are more at ease on bicycles than on horses. And, just like city children, they spend a lot of time watching television or talking to their friends on the telephone.

8] It takes a long time and a lot of money to develop a modern farm. Don has been farming on his own ever since his father died twelve years ago. He had to borrow the money to buy new machinery, new fertilizers, and new feeds. At last he is beginning to make money, and he hopes in a few years to pay off all his loans.

9] With all the help from machines, farming still requires hard work and long hours. Don is up at 5:30 each morning and seldom stops working before late in the evening. But despite the hard work and long hours Don likes his life on the farm. He wouldn't trade it for any other.

INTENSIVE QUESTIONING: *Yes-No* Questions

1. Do machines furnish all the power on modern farms? No, they don't.
2. Do machines furnish most of the power? _____
3. Does human labor furnish any of the power? _____
4. Does it furnish some of the power? _____
5. Do horses furnish any of the power? _____
6. Do horses furnish half of the power? _____
7. Does the farmer keep all kinds of livestock? _____
8. Do the farmer's children go to school by bus? _____
9. Does the farmer's wife work mostly in the house? _____
10. Is hired help often needed? _____
11. Does the farmer use new fertilizers? _____
12. Is the farmer able to produce more food? _____
13. Does it take more labor to produce more food? _____
14. Is more food now produced with less labor? _____
15. Does this mean more farms? _____
16. Does this mean fewer farms? _____
17. Are the farms smaller? _____

INTENSIVE QUESTIONING: *Or* Questions

1. Does machinery or human labor furnish most of the power on modern farms?
   Machinery furnishes most of the power.
2. Does the farmer keep all kinds of livestock, or does he keep only the livestock that can pay its way?

   _____

3. Do the children walk to school, or do they go to school by bus?

   _____

4. Does the farmer's wife work mostly in the house or in the fields?

   _____

5. Does the farmer manage by himself, or does he often need hired help?

   _____

6. Has human labor been replaced by animals or by machines?

   _____

7. Does the modern farmer produce more food or less food?

   _____

INTENSIVE QUESTIONING: *Wh* Questions

1. How much power do machines furnish on modern farms?
   They furnish 96 percent of the power.
2. How much power does human labor furnish?

   _____

3. How much power do horses furnish?

   _____

4. What livestock does the modern farmer keep?

   _____

5. What is the modern farmer like?

   _____

6. How do his children go to school?

   _____

7. Where does the farmer's wife do most of her work?

   _____

8. What does the modern farmer use besides machines?

   _____

9. What is the result?

   _____

10. How many acres are there on the Owens' farm?

    _____

11. Where is the Owens' farm located?

    _____

12. Why are the Owens able to get to town quickly?

    _____

13. Where can the Owens store surplus food?

    _____

14. How do they keep in touch with the news?

    _____

15. How can they call their neighbors and friends?

    _____

16. When can they call their neighbors and friends?

    _____

17. How many cows does Don milk?

    _____

18. Where does the pipeline carry the milk?

    _____

19. Where is Don's herd kept?

    _____

Understanding Ideas

1. What is modern about Don's barn and Betty's kitchen?
2. How does the life of the Owen children differ from the one their parents knew?

Applying the Reading

1. What are the principal crops grown in your country? What kinds of animals and fowl can be found on one of your typical farms? Do these crops and farm animals differ from the ones mentioned in the reading?
2. Do you know how a typical farmer in your country plants and harvests his crops? Does he make use of any machines? If so, what are they?

Composition

1. Notice that paragraph 1 gives a brief description of the old-time farm. The description of the mechanized farm in paragraph 2 provides a comparison or contrast. Go through the two paragraphs and make a list of the ways in which the newer farms differ from the older ones. For example: *The old-time farmer kept many kinds of livestock, while the modern farmer keeps only the livestock that can pay its way.* Using the list you have prepared, write a paragraph which you develop by examples that compare or contrast the two kinds of farm. Begin the paragraph with this sentence: *There are many ways in which the modern mechanized farm differs from the old-time farm.*
2. The first three paragraphs provide a general introduction to mechanized farming. The rest of the reading is devoted to a specific example, a particular mechanized dairy farm in Michigan. How is the description of the farm organized? Can you summarize each paragraph in a single sentence? Some of these sentences can be taken from the reading itself. For example: *Life on the Owens' farm is very different from farm life as many city people might imagine it.*
3. Write a paragraph that begins with the following topic sentence: *If you visited the Owens' farm, you would find machines everywhere—in the house, in the barn, in the fields.*

GRAMMAR REVIEW: Clauses with *If*

Model: The farmers have tractors. They can cultivate more land.
If the farmers have tractors, they can cultivate more land.

6.1 Combine each pair of sentences to make a single sentence with *if*.

1. The farmers have no machines. They must do their work by hand.

_____

2. We need tools. We will get them.

_____

3. Farmers grow extra food. They can sell it in the city.

_____

4. Farmers have more machinery. They can grow more food.

_____

5. The Owens can save enough money. They're going to buy a new freezer.

_____

Model: If the farmer doesn't have machinery, he can't raise a lot of wheat.
If the farmer has machinery, he can raise a lot of wheat.

6.2 Follow the model and change both clauses. Make affirmative clauses negative, and negative clauses affirmative.

1. If he doesn't buy a pump, he won't be able to irrigate.

_____

2. If he didn't have electricity, he couldn't use a milking machine.

_____

3. If the soil is fertilized, it will yield a large crop.

_____

4. If they didn't grow enough wheat, they would have to import it.

_____

5. If we have a heavy rain, we won't have to irrigate.

_____

6. If they hadn't had water, the crops would have failed.

_____

7. If the fence had been strong, the cows wouldn't have broken it.

_____

Clauses with *If*, *Unless*, *Even If*, and *Whether . . . or Not*

Model: If the ground is warm, the seed can be planted.
If the ground isn't warm, the seed can't be planted.
Unless the ground is warm, the seed can't be planted.

6.3 Follow the model to make sentences with *if* and *unless*.

1. If he buys a pump, he'll be able to irrigate his fields.

_____

_____

2. If there is enough rain, he can plant his wheat.

_____

_____

3. If he has electricity, he can use milking machines.

_____

_____

4. If it is fertilized, the land will be productive.

_____

_____

5. If they plow the land properly, they'll keep their rich topsoil.

_____

_____

Model: The farmers will have to irrigate even if it rains.
The farmers will have to irrigate whether it rains or not.

6.4 Follow the model as you form sentences with *whether . . . or not*.

1. Weeds will grow even if the soil is poor.

_____

2. Cows will get into the garden even if the gate is closed.

_____

3. Some farmers will use fertilizers even if they are expensive.

_____

4. Some seeds can be planted even if the ground is cold.

_____

Clauses with *If* and *So That*

Model: If the farmer sold his horses, he could buy a tractor.
Why did the farmer sell his horses?
The farmer sold his horses so that he could buy a tractor.

6.5 Follow the model as you make questions with *why* and statements with *so that*.

1. If the farmer got a washing machine, his wife could do the laundry quickly.
   Why _____
   The farmer _____
2. If he bought an electric stove, the kitchen wouldn't be so hot.
   Why _____
   He _____
3. If he made the kitchen door bigger, the stove and washing machine would go through it.
   Why _____
   He _____
4. If he built a strong floor, the washing machine wouldn't shake it.
   Why _____
   He _____
5. If he put in new wiring, the stove and the machine would work.
   Why _____
   He _____

6.6 Use the following table to make questions with *why* and statements with *so that*.

So that and *why*

Farmers buy new equipment	they can make their homes comfortable.
Farmers want electricity	they can save time and labor.
Farmers need machines	they won't have to work so hard.

Clauses with *If* and Relative Clauses

Model: If farmers have no machines, they must do their work by hand.
Farmers who have no machines must do their work by hand.

6.7 Follow the model as you change the sentences with *if* clauses to sentences with relative clauses.

1. If a farmer doesn't have electricity, he can't use milking machines.
(*who*) _____
2. If a farmer didn't improve his soil, he couldn't raise a big crop.
(*who*) _____
3. If land is fertilized, it is highly productive.
(*that*) _____
4. If farmers live on steep hills, they have difficulty plowing.
(*who*) _____
5. If land is not planted, it will renew itself.
(*that*) _____
6. If milk is to stay fresh, it must be kept cool.
(*that*) _____
7. If cows are well-fed, they will produce better milk.
(*that*) _____
8. If livestock doesn't pay its way, it won't be kept on Don's farm.
(*that*) _____
9. If a child lives on a farm, he sometimes has a pony of his own.
(*who*) _____
10. If children live on a farm, they often go to school by bus.
(*who*) _____
11. If farmers use hybrid seeds, they have larger crops.
(*who*) _____
12. If a farmer has enough machinery, he can produce more food with less labor.
(*who*) _____
13. If machinery is properly maintained, it will last longer.
(*that*) _____
14. If a country has a tropical climate, it can raise bananas.
(*that*) _____

Seven: COMPUTERS: MACHINES WITH ELECTRONIC BRAINS

Tomorrow is here today with machines that can think.

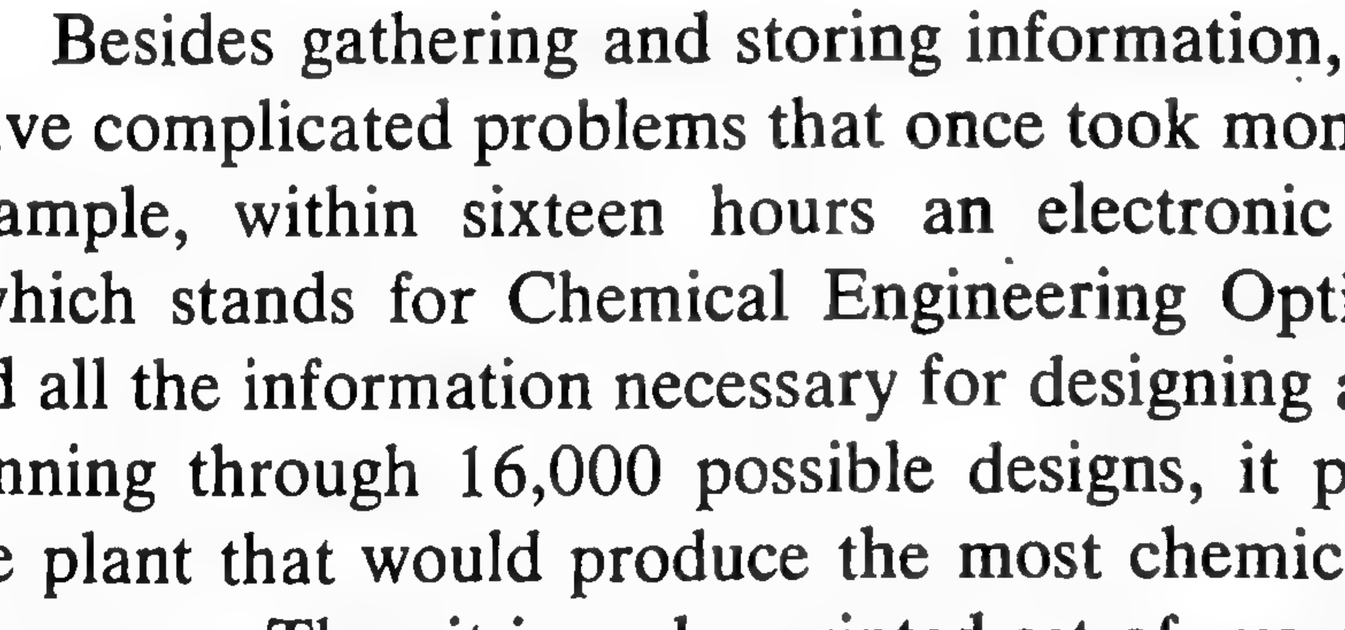
1] With a tremendous roar from its rocket engine, the satellite is sent up into the sky. Minutes later, at an altitude of 300 miles, this tiny electronic moon begins to orbit about the earth. Its radio begins to transmit a staggering amount [1] of information about the satellite's orbital path, the amount of radiation it detects, and the presence of meteorites. Information of all kinds races back [2] to earth. No human being could possibly copy down all of these facts, much less [3] remember and organize them. But an electronic computer can.

2] The marvel of the machine age, the electronic computer has been in use only since 1946. It can do simple computations—add, subtract, multiply, and divide—with lightning speed and perfect accuracy. It can multiply two 10-digit numbers [4] in 1/1,000 second, a problem that would take an average man five minutes to do with pencil and paper. Some computers can work 500,000 times faster than a man.

3] Once it is given a "program"—that is, once it is asked a carefully worked out set of questions devised by a technician trained in computer language—a computer can gather a wide range of information for many purposes. For the scientist it can get information from outer space or from the depths of the ocean. In business and industry the computer prepares factory inventories, keeps track of sales trends [5] and production needs, mails dividend checks, and makes out company payrolls.[6] It can keep bank accounts up to date and make out electric bills. If you are planning a trip by plane, the computer will find out what route to take and what space [7] is available.

4] Not only can the computer gather facts; it can also store them as fast as they are gathered and can pour them out whenever they are needed. The computer is really a high-powered "memory" machine that "has all the answers" [8]—or almost all. What is the name and telephone number of every person in the United States? What is the most efficient speed for driving a car through the New York–New Jersey tunnels? [9] What brand of canned goods is the most popular in a particular supermarket? What kind of weather will we have tomorrow? The computer will flash out the answers in a fraction of a second.

5] Besides gathering and storing information, the computer can also solve complicated problems that once took months for men to do. For example, within sixteen hours an electronic brain named CHEOPS (which stands for Chemical Engineering Optimization System) was fed all the information necessary for designing a chemical plant. After running through 16,000 possible designs, it picked out the plan for the plant that would produce the most chemical for the least amount of money. Then it issued a printed set of exact specifications. Before CHEOPS solved this problem, a team of engineers having the same information had worked for a year to produce only three designs, none of which was as efficient as the computer's.



CHEOPS designs a chemical plant.

6] At times computers seem almost human. They can "read" hand-printed letters, translate scientific papers, play chess, compose music, write plays, and even design other computers. Is it any wonder [10] that they are sometimes called "thinking" machines?

7] Not even computers can predict the future, but the benefits of computers are becoming more obvious every day.

1. Rockets, satellites, and spaceships will be guided by computers.
2. Languages will be translated by computers.
3. Children will be educated in part [11] by television directed by computers. Computers will grade papers at the rate of 6,000 per hour.
4. Computers will keep records of our aches and pains, analyze them, and help the doctor in diagnosing and prescribing medicine for us.
5. Our mail will be sorted by computers.
6. Computers will be used in training airline pilots.
7. Computers will direct flights of planes from one city to another, control their airspeeds and altitudes, and even land them.

Guiding spaceships

Helping doctors

Controlling flights

8] Even though they are taking over [12] some of the tasks that were once accomplished by our own brains, computers are not replacing us—at least not yet. Our brain has more than 10 billion cells. A computer has only a few hundred thousand parts. For some time to come,[13] then, we can safely say that our brains are at least 10,000 times more complex than a computer. How we use them is for us, not the computer, to decide.

Contradiction with *Will* and *Won't*

won't → will

1. Spaceships won't be guided by computers.
   Yes, they ***will.*** They ***will*** be guided by computers.
2. Languages won't be translated by computers.

   _____
3. Children won't be educated by television.

   _____
4. Computers won't grade papers.

   _____
5. Computers won't help the doctor in diagnosing.

   _____

will → won't

6. Spaceships will be guided by telephone.
   No, they ***won't.*** They ***won't*** be guided by telephone.
7. Languages will be translated by radios.

   _____
8. Children will be educated by typewriters.

   _____
9. Papers will be graded by telegraph.

   _____
10. Medicine will be prescribed by nurses.

    _____

won't → will and *will → won't*

11. Spaceships won't be guided by computers.
    Yes _____
12. Spaceships will be guided by telephone.
    No _____
13. Languages won't be translated by computers.
    Yes _____
14. Languages will be translated by radios.
    No _____
15. Children won't be educated by television.
    Yes _____
16. Children will be educated by typewriters.
    No _____

INTENSIVE QUESTIONING: *Wh* Questions

1. What was the name of the electronic brain that designed the chemical plant?

_____

2. What does the name stand for?

_____

3. How long did it take to feed CHEOPS the information?

_____

4. What kind of information was CHEOPS fed?

_____

5. How many designs did it run through?

_____

6. What plan did it pick out?

_____

7. What form was the plan issued in?

_____

8. How long had a team of engineers been working on the same information?

_____

9. What will be guided by computers?

_____

10. How will languages be translated?

_____

11. How will children be educated?

_____

12. How fast will computers grade papers?

_____

13. How will computers help doctors?

_____

14. What will be used in training airline pilots?

_____

15. What other uses will computers have in aviation?

_____

16. How many cells does our brain have?

_____

17. How many parts does a computer have?

_____

18. How many times more complex are our brains than a computer?

_____

Understanding Ideas

1. Why are computers sometimes called "thinking" machines?

2. What did CHEOPS do more efficiently than a team of engineers? Retell the story of CHEOPS and the chemical plant, using your own words whenever you can.

3. Why can we say that our brain is more complex than a computer?

Applying the Reading

1. If you could ask a computer to do three things, what would they be? Would you ask it to solve a mathematics problem for you? To translate English? To write a composition?

2. Suppose you were a businessman. How would your routine work at the office be affected if you had a computer?

3. List the various places (for example, airports) where you feel computers would be useful.

Composition

1. Notice that the first paragraph is introductory. The final paragraph, in comparing the computer with the brain, provides a brief conclusion. Write single-sentence summaries of paragraphs 1 and 8.

2. Beginning with the second paragraph, there is a series of examples showing the uses of computers. Write brief summaries of paragraphs 2 through 7. Each summary should contain a topic sentence and an example.

3. Write a paragraph beginning with the following topic sentence: *The modern computer has many uses, from doing simple computations to solving complicated problems that once took months for men to do.*

GRAMMAR REVIEW: Clauses with *But* and *Though*

Model: I think computers are useful. I don't think they'll replace people.
I think computers are useful, but I don't think they'll replace people.

7.1 Combine each pair of sentences by using *but*.

1. I like computers. I wouldn't want to have one for a doctor.

_____

2. A computer has the answers. Someone has to ask it the right questions.

_____

3. Computers can translate scientific papers. I doubt that they can translate poems.

_____

4. Computers will direct flights. They won't replace pilots.

_____

5. CHEOPS designed a chemical plant. Someone had to feed it the necessary information.

_____

6. Computers will grade papers. They can't discuss your mistakes.

_____

7. Computers can sort mail. They can't deliver it to your door.

_____

8. Computers are complex. Our brains are more complex.

_____

9. A computer has a few hundred thousand parts. Our brain has more than ten billion cells.

_____

10. Men can solve complicated mathematical problems. Computers can solve them much faster.

_____

Model: I think computers are useful, but I don't think they'll replace people.
Though I think computers are useful, I don't think they'll replace people.

7.2 Follow the model as you change sentences with *but* into sentences with *though*. Use the sentences you made in 7.1.

Clauses with *But*, *Though*, and *However*

Model: I like computers, but I wouldn't want to have one for a doctor.
Though I like computers, I wouldn't want to have one for a doctor.
I like computers; however, I wouldn't want to have one for a doctor.

7.3 Follow the model as you change the sentences with *but* into sentences with *though* and *however*. Use a semicolon in sentences that are connected with *however*.

1. I think computers are useful, but I don't think they'll replace people.

2. A computer has the answers, but someone has to ask it the right questions.

3. Computers can translate scientific papers, but I doubt that they can translate poems.

4. Computers will direct flights, but they won't replace pilots.

5. CHEOPS designed a chemical plant, but someone had to feed it the necessary information.

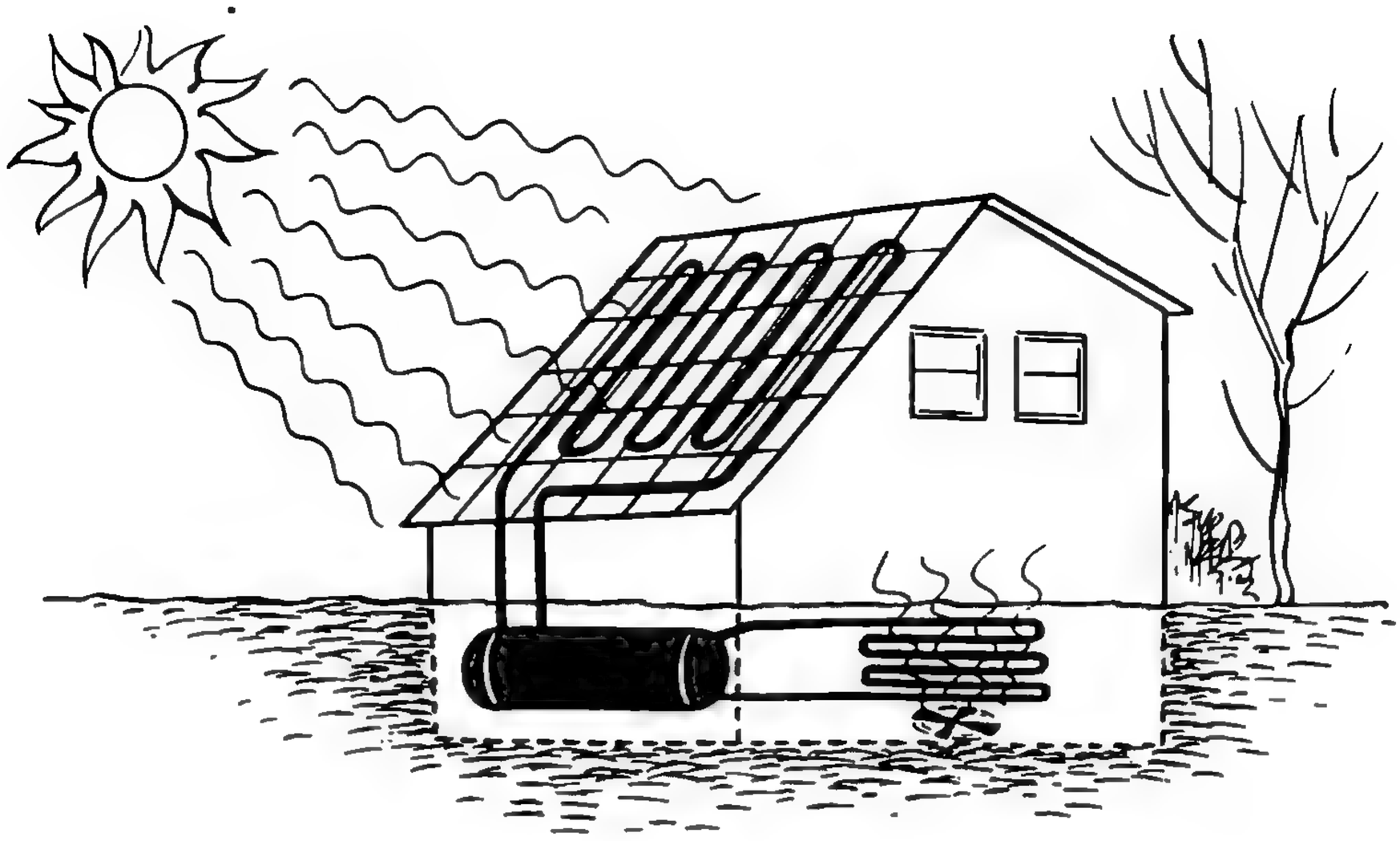
6. Computers will grade papers, but they can't discuss your mistakes.

7. Computers can sort mail, but they can't deliver it to your door.

8. A computer has a few hundred thousand parts, but our brain has more than ten billion cells.

Eight: THE SUN: A NEW SOURCE OF ENERGY

Look to the sky for energy unlimited.



A house heated by the sun

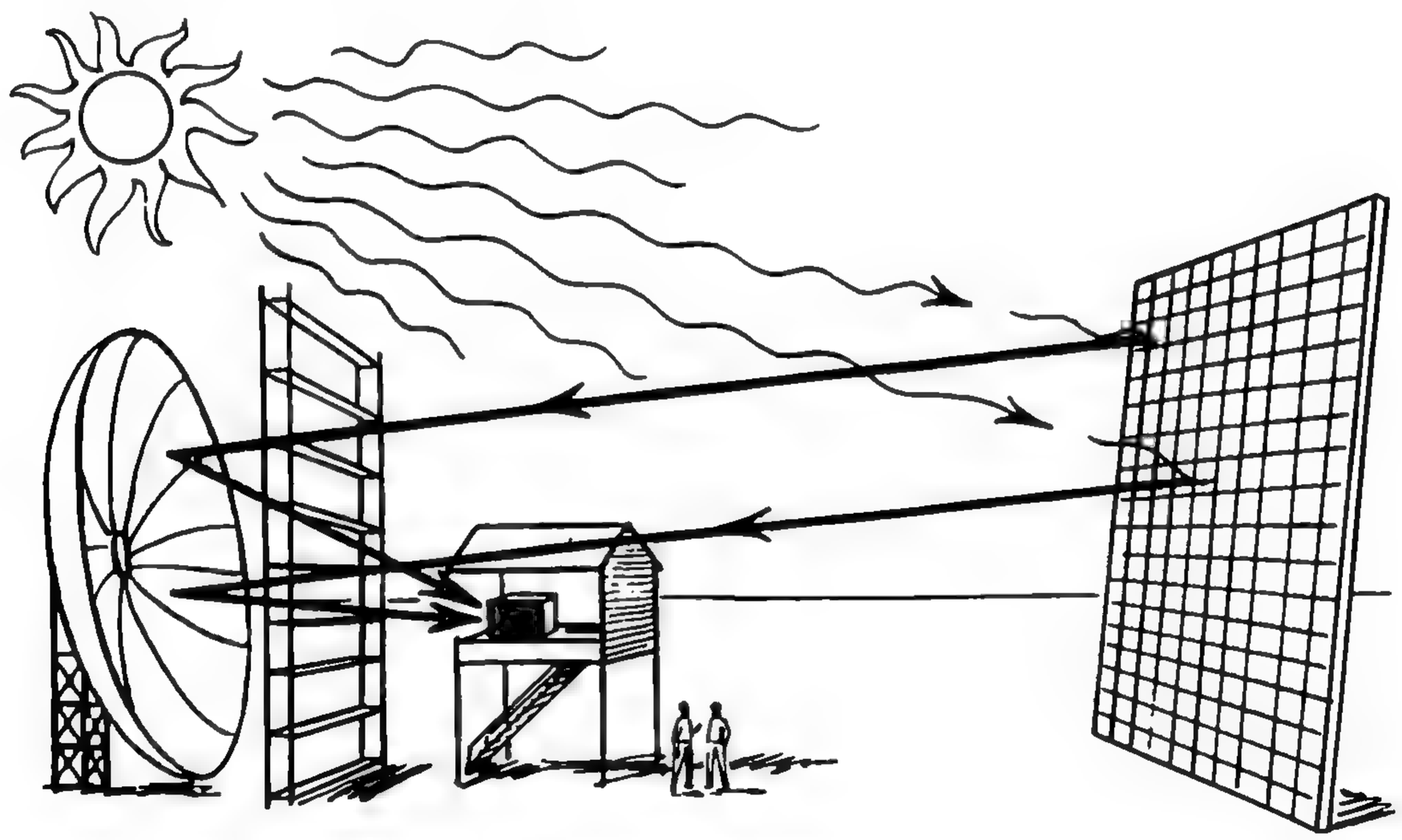
1] A man's muscle power is rated at one-twentieth of a horsepower.[1] The equivalent of 2,000 men pushes a car along the road,[2] while the energy equivalent to that of [3] 100,000 men powers a train. A jet pilot controls energy equivalent to that of 700,000 men.

2] In one year the world uses as much energy as that contained in 21 billion barrels of oil. And the amount of fuel needed is growing by leaps and bounds.[4] What will the future needs be? And how can they be filled? The supplies of fossil fuels—coal, oil, and gas—are limited. They may not last for a century.[5] Then what will take their place? [6]

3] For the answer, let's look to the sky. Each day the sun showers the world with several thousand times as much energy as man uses. The sunshine on your housetop has more than a hundred times more energy than the amount your house receives through the wires which bring electricity to it. It has been estimated that enough energy falls in the 100 square miles of the Arizona desert in one day to run all the industries in the United States for a day and a night.

4] Here, in a sense, is energy unlimited. And the sun's energy is free for the taking.[7] But the materials needed to capture the sun's energy and put it to work[8] are still very expensive. If man could capture even a small part of the sun's energy at low cost, no one would worry about running out of[9] fossil fuels or atomic-energy ores.

5] If scientists succeed in making use of the power of the sun, this new energy will have many different uses. Mirrors can concentrate the sun's energy to create extremely high temperatures that can melt metals. Iron melts at 2800 degrees Fahrenheit, and sunlight has been concentrated by mirrors to produce temperatures several times this high. Many countries that have deposits of valuable ores do not have the fossil fuels needed to refine them. However, there is plenty of free sunshine. So instead of importing expensive fuels, these countries may someday use the free fuel of the sun.

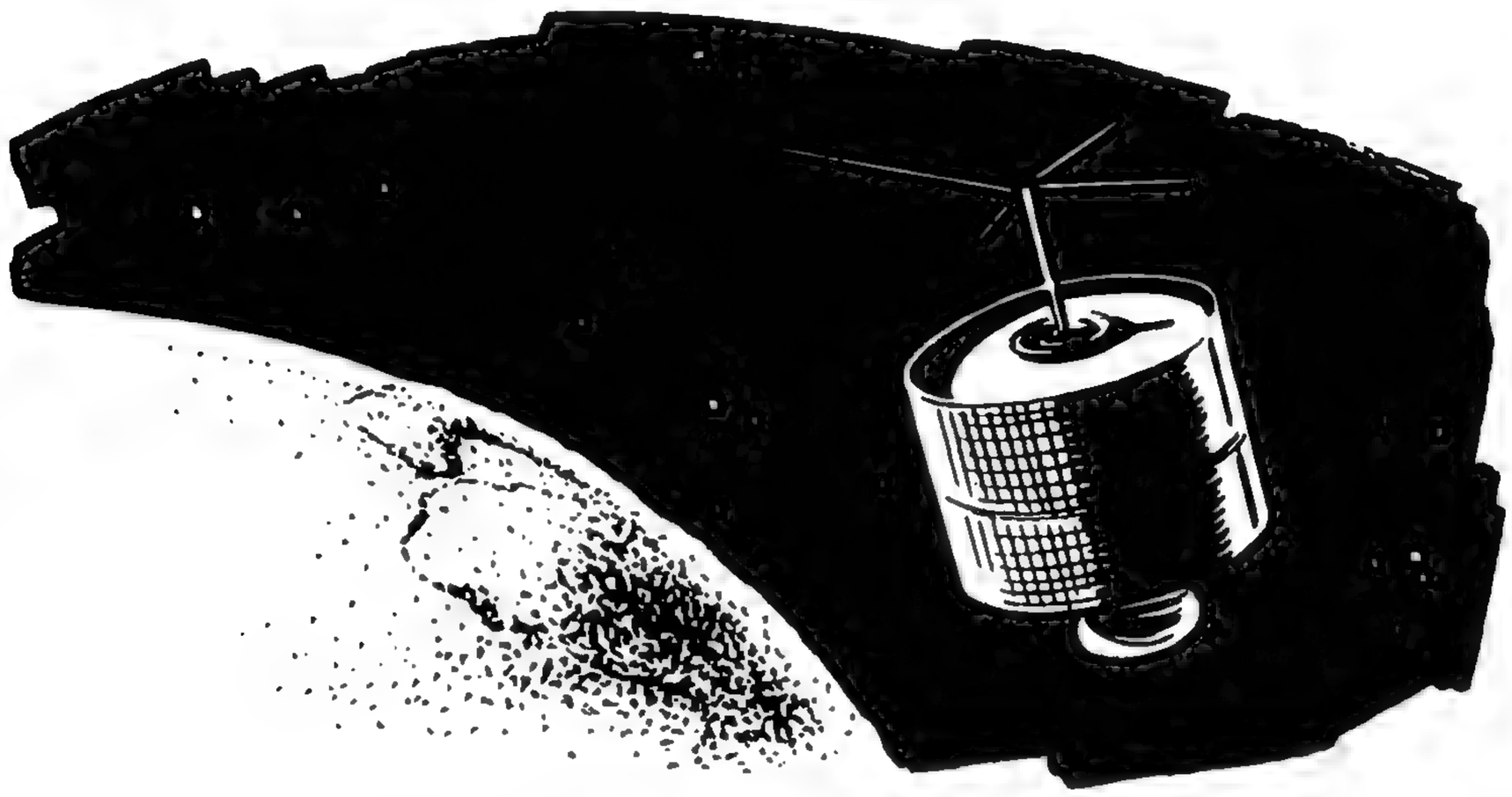


A solar furnace

6] The sun's energy can be used in your own house for heating and cooking. Imagine cooking your dinner on an outdoor solar stove which uses the sun for its source of heat. You could do it in the winter sun, too, for solar stoves are built to focus the sun's energy on a particular area and concentrate the heat. In countries where the supply of fuel is scarce, solar cookers are being used on a limited scale. Unfortunately, for the average user everywhere the price of the solar cooker is too high.

7] The sun can also be used as a source of fuel for power plants. One scientist who has studied the sun's energy for years has developed a solar heater that will produce steam power at a reasonable cost. Such experimental power plants may lead the way to more extensive use of solar energy in running machinery and producing light.

8] Solar energy can be used in telephone communication, in space travel, and in farming. Solar cells have been used experimentally for a number of years to power telephone lines, and they are now being used to recharge batteries which power space instruments. Solar pumps that can raise water for irrigation have also been developed, but they are seldom used because they are too expensive.



Solar electric power in satellites

9] One of the practical problems in controlling solar energy is making it continuous. What can be done when the sun is not shining on the heating system? If you were using a solar pump for irrigation, the interruption of sunlight would not matter, since plants do not need a continuous supply of water, day and night. But suppose you were heating your house by solar energy. A number of experimental houses that are heated in this way use storage tanks to hold the heat for nighttime and rainy spells, or they must have supplementary heating supplied by ordinary fuels.

10] There are other practical problems to be solved before the sun is put to work on a large scale.[10] But once the sun is harnessed, the supply of energy will be inexhaustible. No wonder [11] those who look to the sky see there startling changes in our future way of life.

Contradiction

Negative to Affirmative

1. A horse can't carry more weight than a man. (*can't → can*)
   Yes, it ***can.*** It ***can*** carry more weight than a man.
2. The supply of oil won't be used up. (*won't → will*)
   Yes, it ***will.*** It ***will*** be used up.
3. The sun's energy can't be harnessed. (*can't → can*)

_____

4. The materials needed aren't expensive. (*aren't → are*)

_____

5. High temperatures can't melt metals. (*can't → can*)

_____

Affirmative to Negative

6. A man has more muscle power than a horse. (*does → doesn't*)
   No, he ***doesn't.*** A man ***doesn't*** have more muscle power than a horse.
7. The supply of oil will continue indefinitely. (*will → won't*)

_____

8. The sun's energy is limited. (*is → isn't*)

_____

9. The materials needed are cheap. (*are → aren't*)

_____

10. Low temperatures can melt metals. (*can → can't*)

_____

Negative to Affirmative and Affirmative to Negative

11. A horse can't carry more weight than a man.
    Yes _____
12. A man has more muscle power than a horse.
    No _____
13. The supply of oil will continue indefinitely.
    No _____
14. The supply of oil won't be used up.
    Yes _____
15. High temperatures can't melt metals.
    Yes _____

INTENSIVE QUESTIONING: *Wh* Questions

1. How is a man's muscle power rated?

2. How much energy is needed to power a car?

3. How much energy is needed to power a train?

4. How much energy does a jet pilot control?

5. How much energy does the world use in a year?

6. What are three important fossil fuels?

7. What might take the place of fossil fuels?

8. How much energy does the sun shower the world with each day?

9. How much energy does the sunshine on your housetop have?

10. How much energy falls on the Arizona desert in one day?

11. What would this energy run?

12. How long would this energy run the industries in the United States?

13. How much does the sun's energy cost?

14. How can extremely high temperatures be created?

15. How can the sun's energy be concentrated?

16. How has sunlight been concentrated to produce high temperatures?

17. What can extremely high temperatures melt?

18. What temperature does iron melt at?

Understanding Ideas

1. Why are scientists looking for a new source of energy?

2. Why are scientists especially interested in harnessing the sun?

3. How can the sun's energy be used during the night?

Applying the Reading

1. What kind of fuel do you use for cooking? Where does it come from?

2. Does your country have any natural sources of fossil fuels—any coal mines, any gas or oil wells? Does it export fossil fuels, or does it need to import them?

3. Can you find out how many sunny days you average every year? Would your country be an ideal place (that is, like the desert of Arizona) for experimenting with solar energy?

Composition

1. Find the answers to these questions in the first two paragraphs: *How much energy is being used up? What are the present sources of this energy? Are the supplies limited or unlimited?* Your answers to these questions should show how paragraphs 1 and 2 lead to the main subject—the sun as a source of energy.

2. What is the last question in paragraph 2? Notice that this question is answered in paragraphs 3 and 4. Summarize the answer in a paragraph that begins like this: *What will take the place of fossil fuels? For the answer, let's look to the sky.*

3. Paragraphs 5, 6, and 7 describe some of the uses that could be made of the sun's energy. Make a list of these uses. For example, *The sun's energy can be used in refining ores.* Use this list as a basis for a paragraph of your own that begins with the following topic sentence: *If scientists succeed in harnessing the sun, this new energy will have many different uses.*

GRAMMAR REVIEW: Clauses with *So* and *Because*

Model: We have cold winters in our country. We need to heat our homes.
We have cold winters in our country, so we need to heat our homes.

8.1 Combine each pair of sentences by using *so*.

1. Our country has no oil wells. We must import oil.

_____

2. Our country must import oil. Oil is expensive.

_____

3. Oil is expensive. We can't use it to heat our houses.

_____

4. Our country has large coal deposits. Coal is cheap.

_____

5. Coal is cheap. We use it in our stoves.

_____

6. We have very hot summers. We need air conditioning.

_____

7. Air conditioning is expensive. Not many private homes have it yet.

_____

8. Some children go to school in the summer. Schools should have air conditioning.

_____

9. Offices must stay open all day long. Offices must be air-conditioned.

_____

10. Gas is cheaper than electricity. Some air conditioners are powered by gas.

_____

Model: We have cold winters in our country, so we need to heat our homes.
Because we have cold winters in our country, we need to heat our homes.

8.2 Follow the model as you change sentences with *so* into sentences with *because*. Use the sentences you made in 8.1.

Clauses with *So*, *Because*, and *Therefore*

Model: We have cold winters in our country, so we need to heat our homes.
Because we have cold winters in our country, we need to heat our homes.
We have cold winters in our country; therefore we need to heat our homes.

8.3 Follow the model as you change the sentences with *so* into sentences with *because* and *therefore*. Use a semicolon with sentences that are connected with *therefore*.

1. Our country has no oil wells, so we must import oil.

2. Our country must import oil, so oil is expensive.

3. Oil is expensive, so we can't use it to heat our homes.

4. Our country has large coal deposits, so coal is cheap.

5. Coal is cheap, so we use it in our stoves.

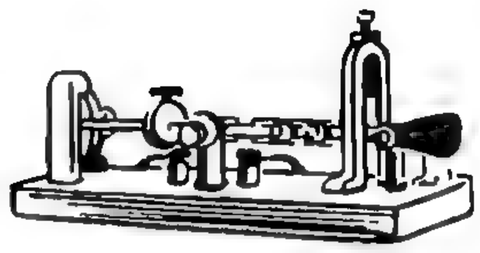
6. We have very hot summers, so we need air conditioning.

7. Air conditioning is expensive, so not many private homes have it yet.

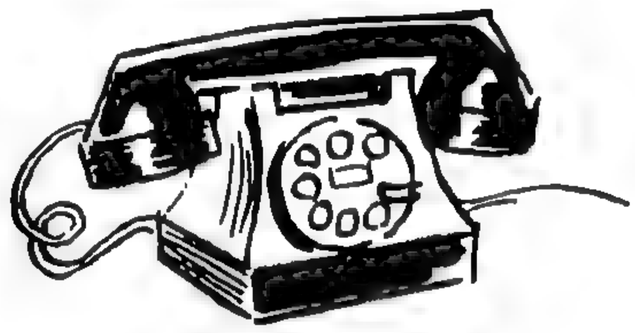
8. Some children go to school in the summer, so schools should have air conditioning.

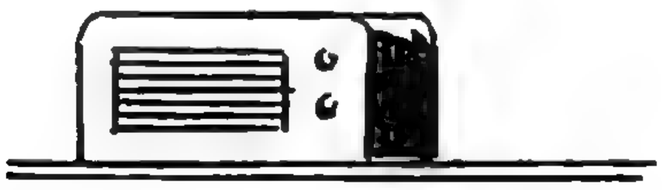
Unit 3: COMMUNICATION

Mail delivery

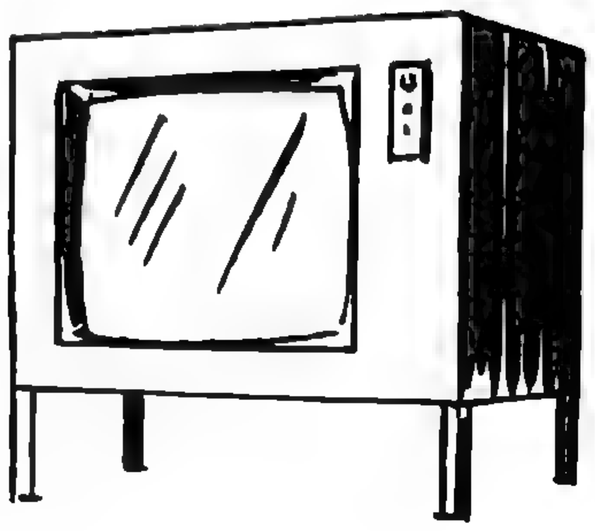


Telegraph and telephone





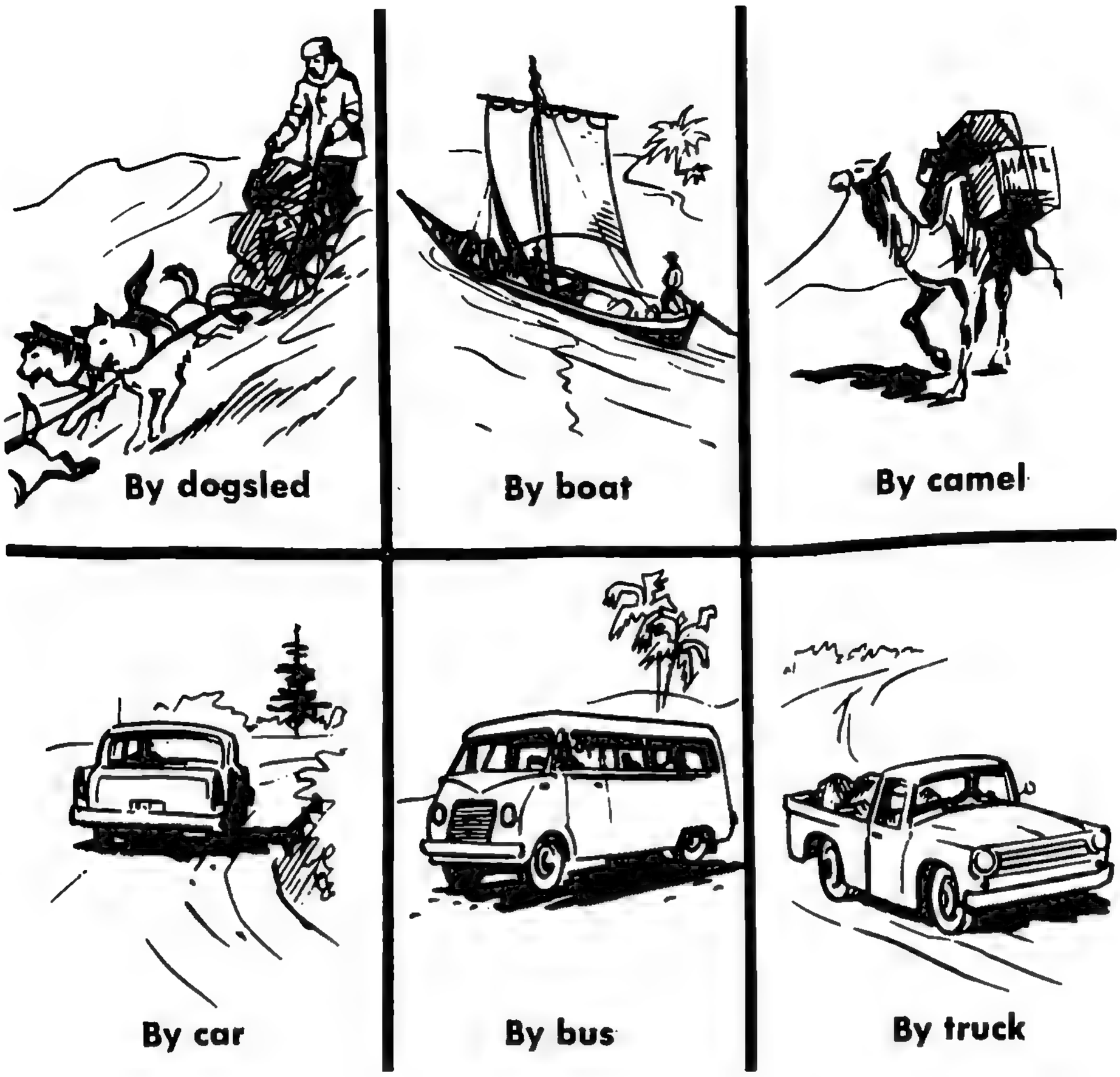
Radio and television



Communications satellites

Nine: THE POSTAL SERVICE

Mail delivery is constantly being speeded up.



1] Today over 100 countries are linked together in the Universal Postal Union, and the number of countries is constantly growing. Within each country mail is carried by the most efficient means possible—by dogsled in the polar regions, by native boat among the islands of the Pacific, by camel in the desert, by car where roads permit, and by train wherever rail schedules exist. In areas where rail service is inadequate or has been discontinued, highway postal routes have been established. On these routes buses or trucks carry the mail.

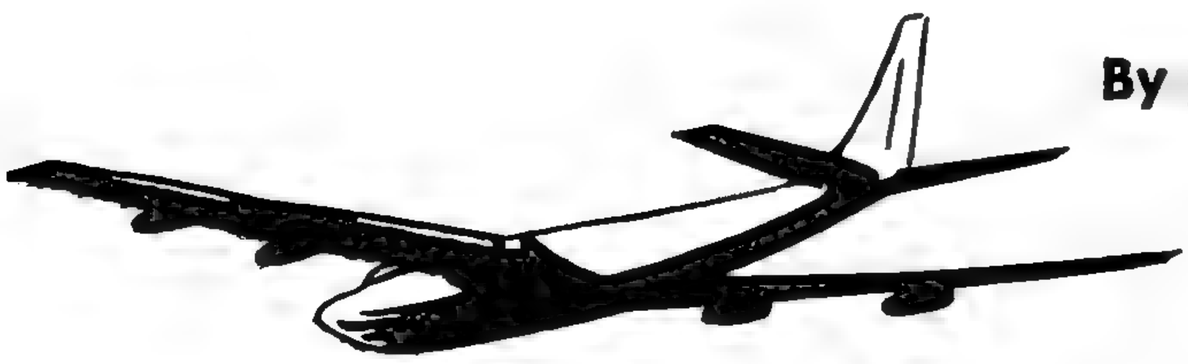
2] But dogsleds, boats, and camels, though often reliable, are undeniably slow. So, under certain conditions, are buses, trucks, and trains. Urgent mail should be sent by some faster means. This is why postal workers are constantly experimenting with new ways of speeding up mail deliveries.

3] The most dramatic change in mail delivery was the addition of airmail service. Established in 1918 between New York City and Washington, airmail service has increased until it now circles the globe.[1] It takes only two hours to carry a letter a thousand miles by fast jets. In addition to letters, small packages, newspapers, magazines, fresh cut flowers,[2] perishable foods, even baby chickens can be sent quickly by airmail.

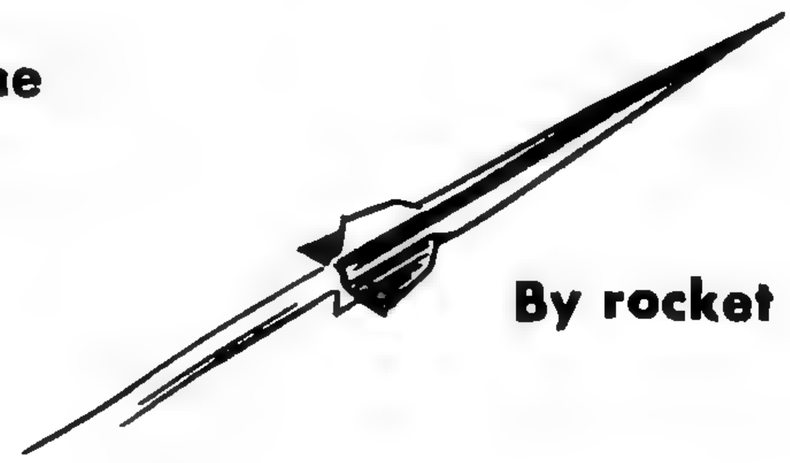
4] To speed up [3] mail deliveries even more, helicopters have been in use since 1917. Helicopters can fly straight up and straight down, forward and backward and sideways. This is why they can shuttle the mail from the airport to the roof of the post office in the center of the city. Their use saves hours of time that would be lost in carrying the mail by trucks through heavy city traffic.

5] With more people writing letters every year, space rockets are now being considered as a possible means of speeding delivery. When that time comes, a rocket could be aimed, for example, from Buenos Aires, Argentina, to New Delhi, India, and arrive in a few minutes.

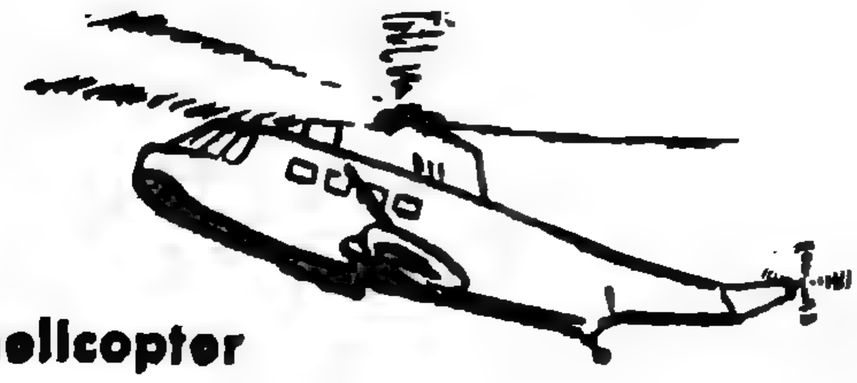
6] Some experimenters are also working with [4] the idea of sending messages by way of space reflectors. By this system, from six to ten huge balloons would be set in space at an altitude of 22 miles. The balloons would rotate at the same speed as the earth does. Messages radioed to the balloons would be reflected back to another point on the opposite side of the earth. Thus a message could be sent around the world in no more than a few seconds.



By plane

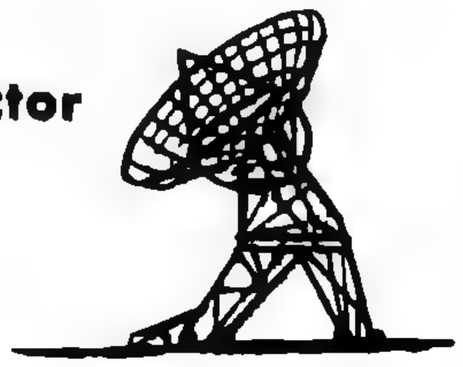


By rocket



By helicopter

By reflector



INTENSIVE QUESTIONING: *Yes-No* Questions

1. Was air service established in 1920? No, it wasn't.
2. Was the first airmail route between New York and Boston? _____
3. Was the first airmail route between New York and Washington? _____
4. Has airmail service increased? _____
5. Does airmail service circle the globe? _____
6. Can fresh flowers be sent by airmail? _____
7. Can baby chickens be sent by airmail? _____
8. Were helicopters used for mail deliveries before 1917? _____
9. Have helicopters been in use since 1917? _____
10. Can helicopters land on the roofs of buildings? _____
11. Does city traffic delay mail? _____
12. Is city traffic light? _____
13. Is city traffic heavy? _____
14. Are trucks faster than helicopters in city traffic? _____
15. Do helicopters save time? _____
16. Are rockets being considered for mail delivery? _____
17. Could a rocket fly from Buenos Aires to New Delhi in a matter of minutes? _____

INTENSIVE QUESTIONING: *Or* Questions

1. Was airmail service established in 1818 or 1918?
   It was established in 1918.
2. Was the first route between New York and Washington or New York and Boston?

   _____
3. Has airmail service increased or descreased?

   _____
4. Does it take four hours or two hours to carry a letter a thousand miles?

   _____
5. Are the jet planes that carry mail fast or slow?

   _____

INTENSIVE QUESTIONING: *Wh* Questions

1. What was the most dramatic change in mail delivery?
   The addition of airmail service.
2. When was airmail service established?

   _____

3. Between what two cities was the first airmail route?

   _____

4. How long does it take to carry a letter a thousand miles?

   _____

5. What besides letters can be sent by airmail?

   _____

6. Why have helicopters been used in mail delivery?

   _____

7. How long have helicopters been in use?

   _____

8. Where do helicopters shuttle the mail?

   _____

9. What are helicopters used for?

   _____

10. Where can helicopters land?

    _____

11. What kind of traffic is there in the city?

    _____

12. What saves hours of time in shuttling mail?

    _____

13. How long would it take a rocket to fly from Buenos Aires to New Delhi?

    _____

14. What idea are some experimenters working with?

    _____

15. How many balloons would be set in space?

    _____

16. What altitude would the balloons be set at?

    _____

17. At what speed would the balloons rotate?

    _____

18. What would the balloons do?

    _____

Understanding Ideas

1. What methods of mail delivery are mentioned in paragraph 1?

2. What besides letters can be sent by airmail? (paragraph 3)

3. How do helicopters speed mail deliveries? (paragraph 4)

Applying the Reading

1. Do you know what the postal rates are in your country? Find out the cost of sending an airmail letter to the following places: North America, South America, Europe, Africa, Asia.

2. What is the chief means of sending mail in your country? By plane, by train, by truck, or by some other means?

3. Why is mail carried by dogsled in the polar regions? By boat in the islands of the Pacific? By camel in the desert? Why can't mail be carried by automobiles in some areas? Do you know any areas where mail must be carried by plane?

Composition

1. Paragraph 1 describes some of the common means of mail delivery. Paragraph 2 provides a transition to some of the more modern methods that are being used or are being experimented with. What do paragraphs 3 through 6 do?

2. Summarize the contents of paragraphs 3 through 6 in a single paragraph. Begin with the following topic sentence: *Speeding up mail deliveries has been accomplished in several ways.*

A post office

GRAMMAR REVIEW: *That* Clauses as Objects

Model: The new post office will be open next week.
The mayor says that the new post office will be open next week.
The mayor says the new post office will be open next week.

9.1 Follow the model to make two more sentences from the given sentence.

1. The post office is a large brick building.
My friend says _____
_____

2. It's on the corner of Main Street and First Avenue.
I think _____
_____

3. The building directory is just beside the main entrance.
I believe _____
_____

4. The elevator is at the end of the hall.
The visitor doesn't know _____
_____

5. You can pick up the package at the window marked "General Delivery."
He has forgotten _____
_____

6. They have a display of rare stamps.
The postmaster says _____
_____

7. The new stamps with the special design are very popular.
I suppose _____
_____

8. I like to collect stamps.
She never remembers _____
_____

9. Stamp collecting is an interesting hobby.
The children have learned _____
_____

10. My father is going to see the postmaster.
I think _____
_____

That Clauses in Reported Speech

Model: "The mail delivery is late."
He complained that the mail delivery was late.

9.2 Follow the model as you tell what someone else has said.

1. "The post office isn't open on Sunday."
   She told us _____
2. "There are many complaints about the new postmaster."
   She said _____
3. "I am tired of writing letters."
   I insisted _____
4. "The mailman is afraid of the neighbors' dogs."
   She thought _____
5. "The dogs are dangerous."
   Someone reported _____

Model: "I hope someone will find my letter."
He hoped that someone would find his letter.

9.3 Follow the model as you tell what someone else has said.

1. "We hope that the new postmaster will be efficient."
   They hoped _____
2. "We believe that he will take our advice."
   They believed _____
3. "I assume that the postman will be on time."
   She assumed _____
4. "I doubt that they can reissue the special stamps."
   She doubted _____
5. "I will give the letter to the mailman."
   She thought _____
6. "I can't afford to send everything by airmail."
   She told me _____
7. "I know that I can't read the address without my glasses."
   She knew _____
8. "I can't remember where my glasses are."
   She said _____

Model: "My mail has been lost before."
She complained that her mail had been lost before.

9.4 Follow the model as you tell what someone else has said.

1. "I have been planning to get a job in the post office."
   She told us _____
2. "There have been many changes recently in the postal rates."
   They said _____
3. "The mail has been delivered already."
   He insisted _____
4. "My letter has been opened by mistake."
   She reported _____
5. "I suppose my brother has forgotten to write."
   He supposed _____
6. "I hope someone has found my letter."
   He hoped _____
7. "We think the new postmaster has tried to improve mail delivery."
   They thought _____

Model: "I found the letter on the sidewalk."
He said that he had found the letter on the sidewalk.

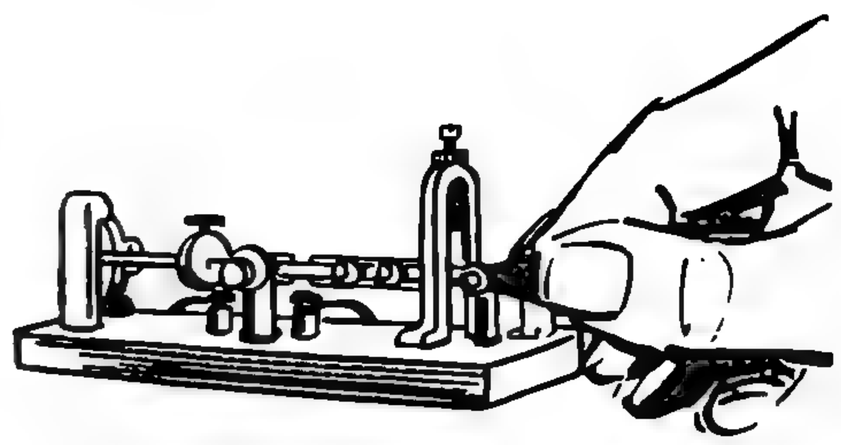
9.5 Follow the model as you tell what someone else has said.

1. "I think I lost the letter on my way home."
   He thought _____
2. "I remember that I had it in my coat pocket."
   He remembered _____
3. "I looked for it everywhere."
   He told us _____
4. "I suppose it fell out of my pocket."
   He supposed _____
5. "I hope I didn't lose anything else."
   He hoped _____
6. "I know I had some change in my pocket, too."
   He knew _____
7. "I tried to be careful."
   He insisted _____

Ten: TELEGRAPH AND TELEPHONE

Sending messages anywhere on this planet

1] Almost as soon as electricity was discovered, inventors saw the possibility of using it to send messages along a wire. But an American named Morse was the first to develop a workable telegraph system that could send messages for hundreds of miles over rivers and mountains, under the ground, and even under the ocean. He invented a code of "dots" and "dashes," sent by making and breaking the current in the circuit to produce a series of clicking sounds or signals. These signals could be put together in various ways to represent letters of the alphabet. For example, in the code as it was later developed, three dots (· · ·) stood for [1] the letter *S* and three dashes (— — —) stood for the letter *O*. Thus three dots followed by three dashes followed by three dots (· · · — — — · · ·) would stand for the letters SOS, now recognized internationally as a signal of distress.



A telegraph operator

2] An experienced telegraph operator can translate these dots and dashes at a rate of forty to fifty words per minute, and he can send messages through a telegraph key at the same rate. But for most purposes this rate is not fast enough. After many experiments an automatic sending and receiving system has been developed. This new system is capable of sending and receiving almost 400 words per minute.

3] If you should visit a newspaper office, you might see six or seven typewriters busily typing out messages. You might be startled at first, for you would see no one sitting in front of the typewriters. They are automatic receiving machines. Hour after hour they receive messages, translate them into different kinds of electrical impulses, and direct the typewriters to put the messages on paper.

An automatic machine

4] Still other inventions have improved on Morse's basic model. One machine can amplify the signals—that is, make them stronger—and send them again along the wire. Another machine permits sending several messages at the same time along the same wire. These developments have made a hand-operated telegraph a rare sight today. Now almost all telegraphic messages can be sent by automatic machines across hundreds, even thousands, of miles in an instant.

5] While telegraph service was being improved and telegraph lines were encircling the whole earth, scientists were working on a related idea. This was the idea of speaking directly—instead of sending signals—to a person at a distance. For more than a century simple devices had been made that would transmit sound waves. But these were regarded as little more than toys, and few people took them seriously.[2] Among the few who did was a Scotsman named Alexander Graham Bell.

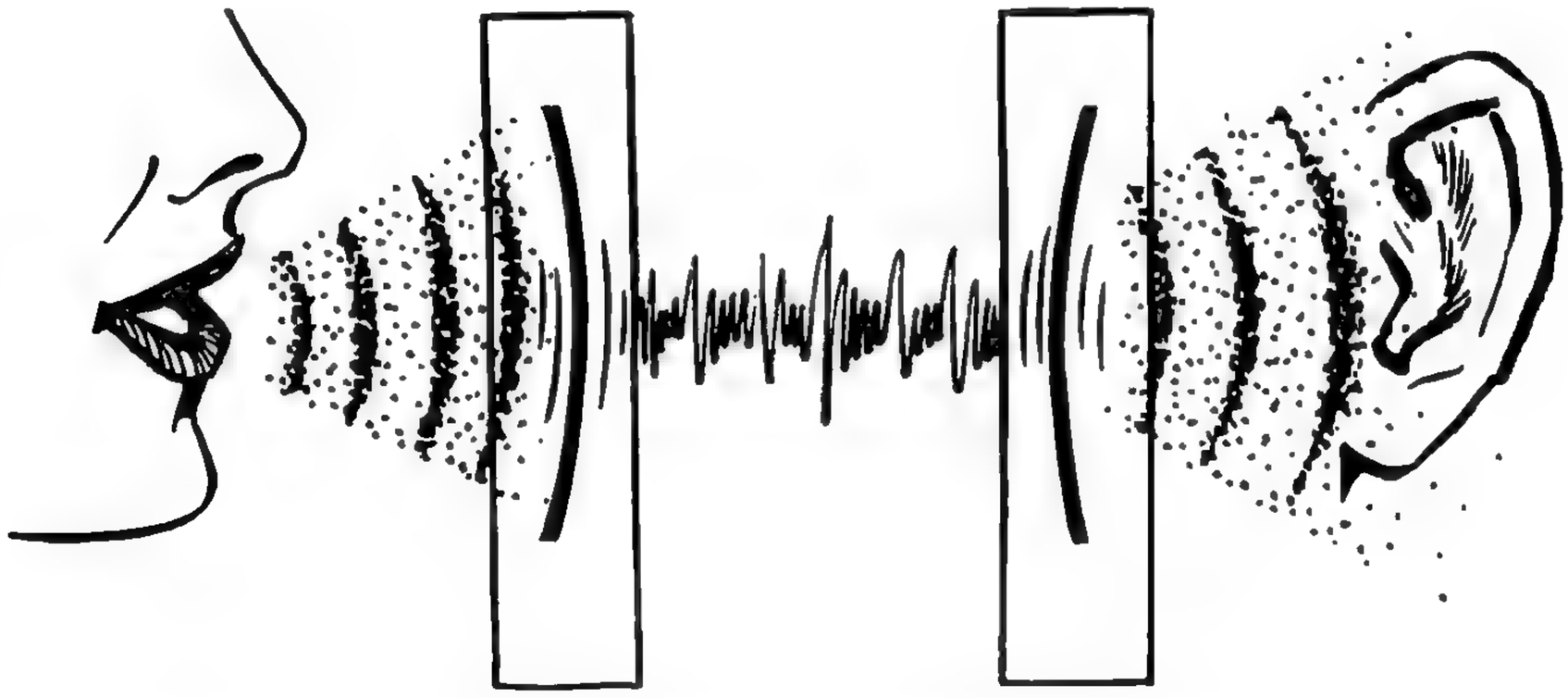
6] Bell was born in Scotland in 1847, but when he was a young man of twenty-three he moved with his parents to Canada. Before the year was over, young Graham had left his family and gone to Boston. Though Bell was a dreamer, he was also a practical thinker and a man of action. In Boston, where he worked by day as a teacher of the deaf, he worked far into the night experimenting with the electrical transmission of sound. "You can't make an owl sleep at night," he once wrote in a letter. "The more I explore this wonderful subject of electricity, the more boundless seems the prospect before me."

"Mr. Bell, I heard every word you said—distinctly."

7] His reward came on March 10, 1876. That evening when he was conducting an experiment, he accidentally spilled some acid on his clothes. He called to his assistant in another room, "Mr. Watson, come here, I want you." Watson, who was holding the receiving telephone to his ear, heard the words and rushed to tell the inventor, "Mr. Bell, I heard every word you said—distinctly." The first complete sentence had been transmitted by telephone.

8] Bell was twenty-seven years old when he worked out [3] the principle of sending speech electrically. But his invention was more than a happy accident [4] of youth. It was the result of long years of scientific training, from which he had gained a special understanding of the way speech sounds are created and heard. Bell knew, for example, that when we speak, everything within the sound of our voice vibrates in response to our vibrating vocal cords. He knew that when we speak, nearby books vibrate, chairs vibrate, walls, tables, pictures, and lamps vibrate. Knowing this, Bell reasoned correctly that a thin metal disk would vibrate as he talked against it. The tiny particles of air set in motion [5] by the voice of the speaker would move the disk just as they move the eardrum.

9] This is just what happens when you speak into a telephone. The vibrations of your voice cause the thin metal plate to bend and to press on several small pieces of carbon. As these pieces of carbon are pressed together, they create electricity in very tiny amounts. The tiny electrical impulses travel along the wire at the speed of light. When they reach their destination, they turn themselves back into sound waves that the eardrums can pick up.



10] Telephones have been rapidly perfected until today, when it is possible for a businessman in San Francisco to call a businessman in Tokyo and have a conversation completely free of noise. And the telephone of tomorrow promises even more exciting things: (1) a "picture telephone" that will allow you to see the person you are talking to; (2) a pocket telephone that folds up to the size of a cigarette case and can be carried around with you; and (3) someday, perhaps, a high-speed device that will let you talk to anyone on this planet—and even beyond.

INTENSIVE QUESTIONING: *Yes-No* Questions

1. Was Bell born in England? No, he wasn't.
2. Was Bell born in 1747? _____
3. Did Bell's family move to the United States? _____
4. Did Bell's family move to Canada? _____
5. Did Bell move to Canada when he was twenty-five? _____
6. Did Bell go to Boston before the year was over? _____
7. Was Bell a dreamer? _____
8. Was he a man of action? _____
9. Was Bell a student by day? _____
10. Was he a teacher by night? _____
11. Was Bell a teacher of the deaf? _____
12. Did he experiment with the transmission of sound? _____
13. Did Bell say you could make an owl sleep at night? _____
14. Did Bell explore the subject of electricity? _____
15. Did he think electricity was a wonderful subject? _____
16. Did he think the prospect was limited? _____
17. Did he think the prospect was boundless? _____
18. Did he spill the acid on purpose? _____

INTENSIVE QUESTIONING: *Or* Questions

1. Was Bell born in England or in Scotland?
   He was born in Scotland.
2. Did his family move to Canada or the United States?

   _____
3. Did he go to Boston or stay in Canada?

   _____
4. Was Bell a teacher or a doctor?

   _____
5. Did he teach the blind or the deaf?

   _____
6. Did he experiment by night or by day?

   _____
7. Did Bell refer to owls or to cows in his letter?

   _____

INTENSIVE QUESTIONING: *Wh* Questions

1. When was Bell born?
   He was born in 1847.
2. Where was Bell born?

_____

3. Where did Bell's family move when he was twenty-three?

_____

4. Where had Bell gone before the year was over?

_____

5. What kind of man was Bell?

_____

6. What did Bell do by day?

_____

7. What did he do by night?

_____

8. Who did Bell teach?

_____

9. How late at night did he work?

_____

10. What did he experiment with?

_____

11. What did Bell once write in a letter?

_____

12. When did his reward come?

_____

13. What was he doing that evening?

_____

14. What did he spill on his clothes?

_____

15. What did he spill acid on?

_____

16. Who did he call to?

_____

17. Who was his assistant?

_____

18. Who was Mr. Watson?

_____

19. What did Bell say to Mr. Watson?

_____

Understanding Ideas

1. Why are automatic machines replacing telegraph operators? (paragraph 2)

2. How was Bell's job during the day related to his experiments during the night? (paragraph 6)

Applying the Reading

1. A string telephone is the simplest kind of telephone. Have someone in the class make a string telephone and explain how it works.

2. How much would it cost to send a cablegram from your country to New York? How much would it cost to make a telephone call to New York? Is a cablegram much cheaper than a telephone call? What could you accomplish in a telephone call that you could not accomplish in a cablegram?

3. Why do we need to make telephone calls? What kinds of people (for example, doctors) must depend on telephones every day? What reasons do you have for making telephone calls?

Composition

1. This reading has two main parts, the first on the telegraph and the second on the telephone. Notice that the transition between these two parts is made in paragraph 5. Pick out the phrases that help to relate the telegraph with the telephone.

2. Notice that paragraphs 6 and 7 tell a story about Bell. Study these paragraphs carefully. What kind of man was Bell? What did he do to make a living? What did he do in his spare time? Try to retell paragraphs 6 and 7 in your own words. Your teacher will write the quotations from Bell on the blackboard so that you can use them in your story.

3. Notice that paragraph 8 explains a simple principle which is then applied in paragraph 9. What is this principle? How was it applied? Try to combine your answers to these two questions in a single paragraph that begins with these two sentences: *Bell had a special understanding of the way speech sounds are created and heard. This understanding helped him to develop the telephone.*

GRAMMAR REVIEW: From *Wh* Questions to Object Clauses

Model: When did Bell invent the telephone?
I must ask when Bell invented the telephone.

10.1 Include the first sentence in the second.

1. What did the first telephone look like?
   We're going to learn _____
2. How many telephone companies are there in your country?
   I want to know _____
3. Why are night rates less expensive?
   I wonder _____
4. When did telephones first begin to use a dial system?
   Do you know _____
5. Where can I find a telephone?
   I'm going to ask _____
6. How does one reach the long-distance operator?
   The boy is asking _____
7. Where do I pay the telephone bill?
   I want to know _____
8. Why are those receivers off the hook?
   Can you tell me _____
9. What is a person-to-person call?
   Do you know _____
10. What number can we dial for information?
    We must find out _____
11. What does it cost to make a station-to-station call?
    Can you tell me _____
12. Whose telephone is ringing?
    We'd better see _____
13. What is a "singing" telegram?
    I'd like to know _____
14. What is the charge for a cablegram to New York?
    I've forgotten _____
15. What should I do to make a long-distance call?
    I must find out _____
16. When did you get your new telephone?
    Do you remember _____

Model: A man named Bell invented the telephone.
Who invented the telephone?
She can't remember who invented the telephone.

10.2 First make a question that asks about the words in ***boldface.*** Then put the question into a larger sentence after *ask*, *forget*, *know*, *remember*, or *wonder*.

1. ***The typewriter*** puts the message on paper.
   What _____
   Do you know _____
2. Telephones became common ***in the twentieth century.***
   When _____
   The children asked _____
3. They have a telephone ***in the kitchen.***
   Where _____
   I've forgotten _____
4. ***Cheap electricity*** made wide use of the telephone possible.
   What _____
   I wonder _____
5. The telephone failed ***because ice broke the wires.***
   Why _____
   We wondered _____
6. You can find out the correct time ***by dialing a certain number.***
   How _____
   Are they asking _____
7. She asked for ***the nearest telephone.***
   What _____
   I forgot _____
8. A long-distance call is ***a call from one city to another.***
   What _____
   She's wondering _____
9. ***Not long ago*** it became possible to make telephone calls across the Atlantic Ocean.
   When _____
   She couldn't remember _____
10. ***Automatic dialing*** has reduced the number of operators.
    What _____
    Do you know _____

So as a Substitute for Object Clauses

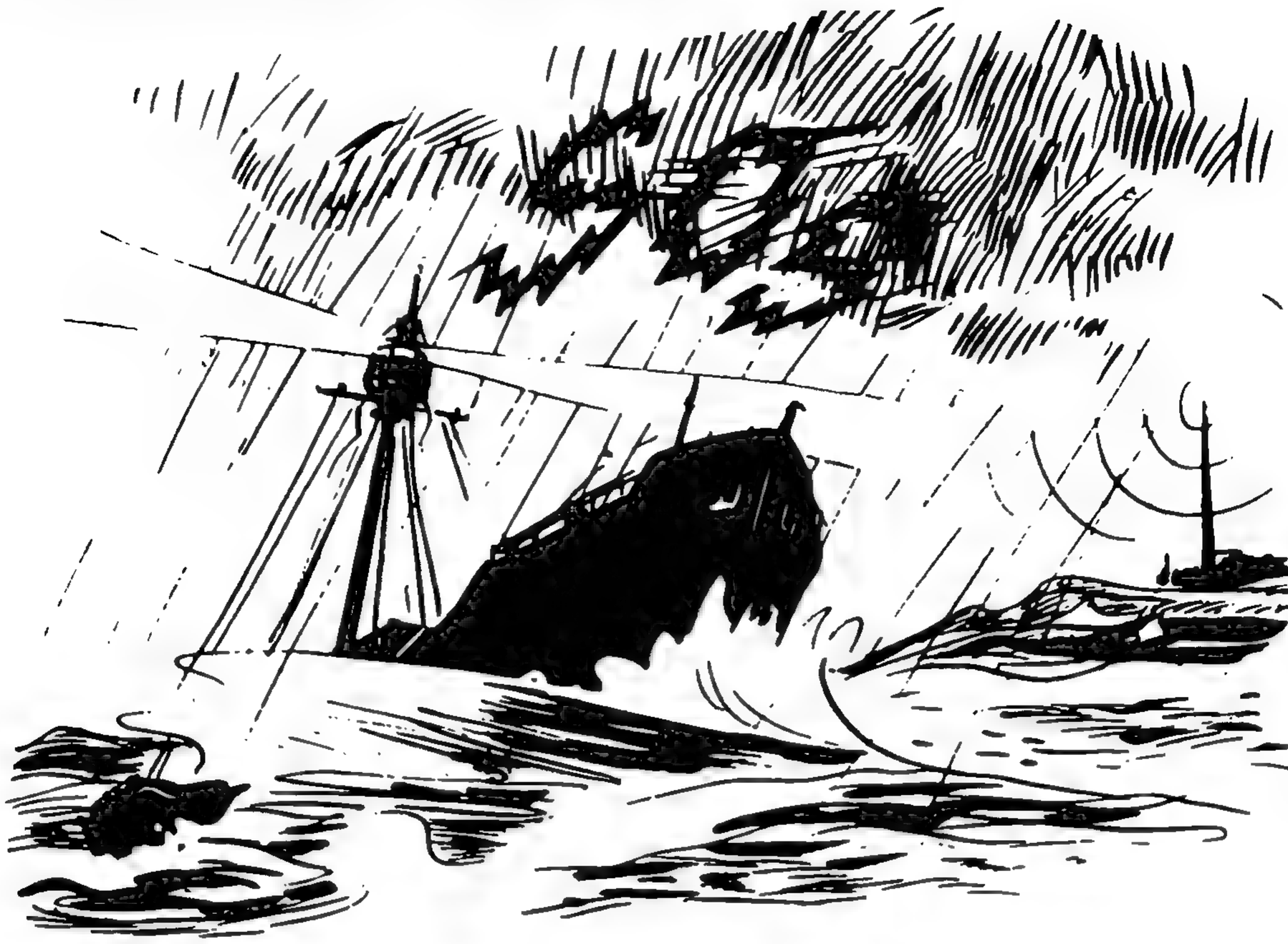
Model: Did the telegram arrive in time?
I think it arrived in time.
I think it did.
I think so.

10.3 Follow the model as you answer each question three times.

1. Has the new telephone been connected?
   I hope _____
   I hope _____
   I hope _____
2. Was the telephone service cut off during the storm?
   I suppose _____
   I suppose _____
   I suppose _____
3. Is it faster to make a phone call than to send a telegram?
   I imagine _____
   I imagine _____
   I imagine _____
4. Did the telephone company raise its rates last month?
   I believe _____
   I believe _____
   I believe _____
5. Is it possible to dial a long-distance call?
   I think _____
   I think _____
   I think _____
6. Should we send the telegram collect?
   I guess _____
   I guess _____
   I guess _____
7. Are cablegrams sent by cables beneath the sea?
   I suppose _____
   I suppose _____
   I suppose _____

Eleven: RADIO AND TELEVISION

Hearing and seeing across the world



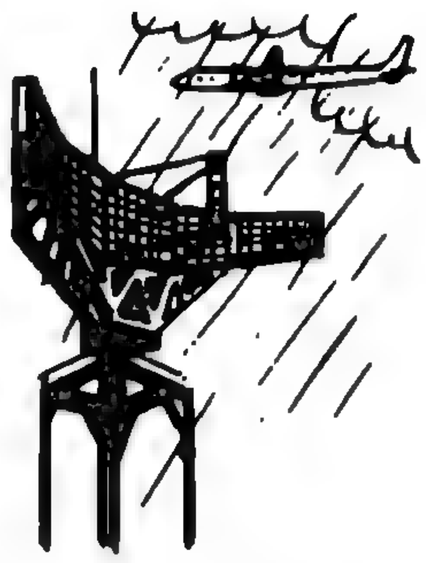
1] Radio waves are a mystery. Though scientists assume that they are a form of electrical energy, no one as yet has been able to prove it. But even though scientists are not quite sure what radio waves are, they are constantly learning how to make use of them.

2] One of the first scientists to experiment with their use was an Italian named Marconi. In 1897 he formed a wireless company to install wireless sets in ships at sea, in lightships,[1] and in lighthouses along the coast of England. With such equipment, he believed that a ship in danger of sinking could radio for help. Two years later he was proved right. A lightship, pounded and damaged by heavy seas, radioed a nearby station and got help in time to prevent loss of life.

3] After Marconi's success, other scientists in Europe and America started experimenting with radio waves. But it was not until 1920 that regular radio broadcasts began. Although they were immediately popular, they still had many defects. The sound was thin and unnatural, and the voices were often blurred by static. Even worse, listeners had to wear earphones [2] that were both annoying and inconvenient.

4] Since then dependable radios have been developed that are doing much to change our lives. Today we can hear about a news event within minutes after it happens. People who might never attend a concert can hear a brilliant symphony orchestra merely by turning on their radio. Radios in police cars have improved law enforcement. Radio waves are used in radar, which is indispensable to jet pilots in bad weather. And whole classes of students in many countries are being taught by radio.

Radio in police cars



Radio in radar

Radio for teaching

Radio for music

5] Yet the average person is happier when he can see what he is hearing. So he turns to television. On its screen he can see the news as it is happening. He can see master musicians and watch fine plays. He can watch an expert show him how to grow crops better and how to care for his health. All this and much more he can see and hear from a chair in his own home.

6] Since its introduction television has become worldwide,[3] reaching millions of viewers on every continent. Yet no single inventor can claim credit for [4] television—no Samuel Morse, no Alexander Graham Bell, no Marconi. Rather, it is the product of many minds from many nations—Germany, France, the Soviet Union, and the United States.

7] As wonderful as it is to get simultaneous sight and sound, television broadcasting is still limited in space. While it is simple to make a telephone call from San Francisco to Tokyo, it is difficult to broadcast a live television program between these two places. But beginnings are already being made in international television broadcasting by means of "communications satellites" that orbit high above the earth. Television viewers in San Francisco were able to watch the 1964 Olympic Games in Tokyo by means of a communications satellite named Syncom.

INTENSIVE QUESTIONING: *Yes-No* Questions

1. Did Marconi experiment with radio waves? Yes, he did.
2. Was he one of the first to experiment with their use? _____
3. Was Marconi an American? _____
4. Was Marconi an Italian? _____
5. Did he form a company in 1887? _____
6. Did he form a company in 1897? _____
7. Did the company install wireless sets in ships at sea? _____
8. Did the company install them in lighthouses? _____
9. Were the lighthouses along the coast of Italy? _____
10. Were they along the coast of England? _____
11. Were wireless sets also installed in lightships? _____
12. Could a sinking ship radio for help? _____
13. Was Marconi proved wrong? _____
14. Was he proved right? _____
15. Did a lightship radio a nearby station? _____
16. Did a lightship radio a station far away? _____
17. Did help come too late? _____
18. Did help come on time? _____

INTENSIVE QUESTIONING: *Or* Questions

1. Did Marconi experiment with light waves or with radio waves? He experimented with radio waves. (He didn't experiment with light waves.)
2. Was Marconi one of the first or one of the last to experiment with radio waves?

_____

3. Was Marconi an American or an Italian?

_____

4. Did he form a company in 1887 or 1897?

_____

5. Did the company install sets in lighthouses or in private homes?

_____

6. Were the lighthouses along the coast of England or the coast of Italy?

_____

INTENSIVE QUESTIONING: *Wh* Questions

1. What did Marconi experiment with?
   Radio waves. He experimented with radio waves.
2. Where was Marconi from?

   _____

3. What country was Marconi from?

   _____

4. When did he form his company?

   _____

5. What did he install in ships?

   _____

6. Where did he install wireless sets?

   _____

7. Where were the lighthouses?

   _____

8. What did Marconi believe?

   _____

9. What could a ship in danger of sinking do?

   _____

10. When was he proved right?

    _____

11. What was pounded and damaged by heavy seas?

    _____

12. What did the lightship do?

    _____

13. What did it radio for?

    _____

14. What did it get?

    _____

15. When did help come?

    _____

16. When did the first regular broadcast begin?

    _____

17. What did the first broadcast sound like?

    _____

18. What were the voices blurred by?

    _____

19. What did the listeners have to wear?

    _____

Understanding Ideas

1. What were some of the defects to be found in early radio broadcasts? (paragraph 3)

2. What countries made important contributions to the development of television? (paragraph 6)

3. How is international television broadcasting going to be accomplished? (paragraph 7)

Applying the Reading

1. How much time do you spend listening to the radio or watching television? What kind of programs do you like? Has either radio or television changed your daily routine in any way?

2. Do you understand how radio or television could be used in teaching? How could they be used in your classroom?

3. The reading mentions several ways in which radio and television can be used. Can you think of others?

Composition

1. Like the previous reading, this one has two main parts, the first on radio and the second on television. Notice that the transition between these two parts is made in paragraph 5. Pick out the phrases that help relate the two subjects.

2. There is a clear sequence of time in paragraph 2. In the first sentence, for example, Marconi is referred to as "one of the first scientists to experiment" with radio waves. Pick out the three other phrases in the paragraph that help to establish the sequence of time.

3. Notice that the first sentence in paragraph 4 is the topic sentence. What is the subject of the paragraph? Notice that paragraph 4 is developed by using five examples. What are they? Using the following topic sentence, write a paragraph which you develop in the same way: *Radio and television have done much to change our everyday life.*

GRAMMAR REVIEW: Adjective + *That* Clauses

Model: Our television set is broken.
(*sorry*) We're sorry that our television set is broken.

11.1 Follow the model and change each sentence to one with adjective + *that*.

1. Marconi was one of the first to experiment with radio waves.
   (*sure*) I am _____
2. Studies of the radio wave were made before Marconi.
   (*aware*) They are _____
3. Many people have improved on Marconi's invention.
   (*unaware*) He was _____
4. Television sets are becoming cheaper all the time.
   (*glad*) I am _____
5. Her radio needs repairing.
   (*afraid*) She is _____
6. Good radio programs can be heard everywhere.
   (*glad*) I am _____
7. This radio will operate on batteries.
   (*certain*) He is _____
8. I can afford to buy a new radio.
   (*delighted*) I am _____
9. The Japanese make radios you can put in your pocket.
   (*sure*) I am _____
10. Everybody can now hear good music every night.
    (*happy*) We are _____
11. English can be taught by radio to thousands of people.
    (*sure*) Are you _____
12. You couldn't watch the Olympic Games on television.
    (*sorry*) Were you _____
13. Television broadcasting is still limited in space.
    (*certain*) I am _____
14. Some symphony orchestras have weekly broadcasts.
    (*positive*) We are _____

11.2 Learn the meanings of the following words: *confident, conscious, determined, distressed,* and *gratified.* Use them in sentences like those in 11.1.

It's + Adjective + *That* Clauses

Model: Television will replace radio in many homes.
(*probable*) It's probable that television will replace radio in many homes.

11.3 Follow the model and change each sentence to one with *It's* + adjective + *that*.

1. Most countries will soon have television stations.
   (*likely*) _____
2. Television can do more harm than good.
   (*possible*) _____
3. Children often watch television when they should be studying.
   (*unfortunate*) _____
4. They also learn a great deal from television.
   (*certain*) _____
5. There are many special programs for children.
   (*good*) _____
6. Television is now being used to teach large classes.
   (*interesting*) _____
7. Some cities have more than one television station.
   (*true*) _____
8. Television will be used exclusively in the classroom.
   (*improbable*) _____
9. Americans call it "TV," but the British call it "Telly."
   (*funny*) _____
10. Radio will be replaced entirely by television.
    (*unlikely*) _____
11. All television programs are good for children.
    (*untrue*) _____
12. All television programs should be educational.
    (*doubtful*) _____

11.4 Be sure you know the meanings of the following words: *right*, *wrong*, *appropriate*, *reasonable*, and *amusing*. Use them in sentences like those in 11.3.

Twelve: COMMUNICATIONS SATELLITES

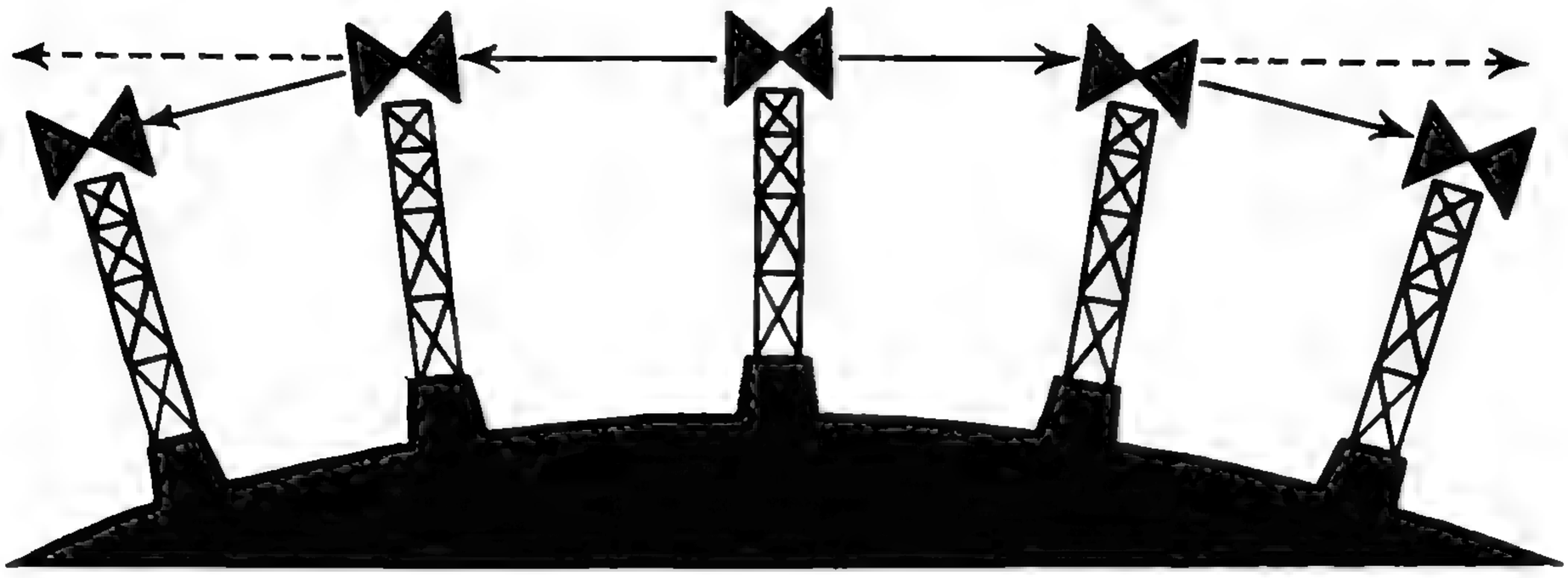
Relaying messages from satellites high above the earth

Microwaves sent by an orbiting satellite can travel vast distances.

1] The usual pathways for long-distance communication have led along the earth's surface, under the oceans, and through the lower atmosphere. Not one of these routes has yet provided all the capacity, speed, or quality we need. Present underseas cables have a limited capacity; surface travel by ship is too slow for anything but routine mail; shortwave radio is likely to have distortion and noise, and the available frequencies are rapidly being used up.[1] Although jet planes can fly across the oceans in a few hours with mail and taped television shows, the big need is to send information instantaneously. And the communications satellite offers us a very promising way [2] to do this.

2] Fortunately the communications satellite doesn't require new technical knowledge. It can use a device already available: the microwave radio relay. Microwaves differ from the ordinary radio waves in that they have a higher frequency or rate of vibration per second. Today microwaves are used routinely in sending thousands of telephone calls and television programs across long distances. They give high-quality performance, and they can carry many messages at the same time.

3] But there has always been one problem in using radio relay in overseas communications. Extremely-high-frequency waves can travel almost unlimited distances, but they travel only in straight lines. Since the curvature of the earth limits a microwave's line-of-sight path to about 30 miles, good reception requires a series of relay towers spaced every 30 miles or so. Obviously it isn't possible to build these towers across the ocean. But if we could find a way to send signals high up into the sky and then bounce them back again to a far-off spot, we could send microwave messages long distances.

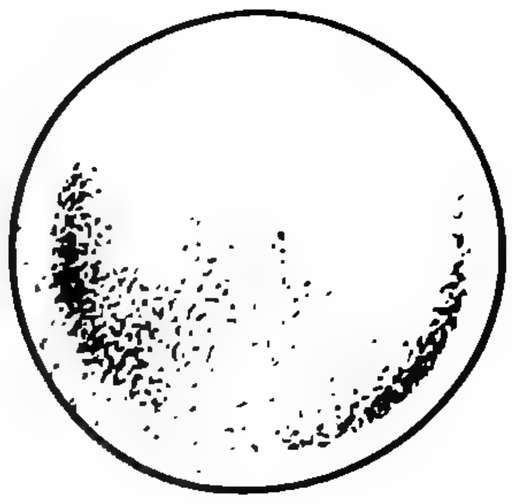


Curvature of the earth requires towers to be about 30 miles apart.

4] As long ago as 1945, Arthur C. Clarke, an English scientist, proposed that a man-made satellite orbiting in space might be used to relay signals in this way. In 1945, of course, the idea of getting a satellite out into space seemed fantastic. But within ten years, though Sputnik had not yet been launched, artificial satellites were close to reality.[3] And an American named John R. Pierce had made the first serious study of what would have to be done to build a working satellite communications system.

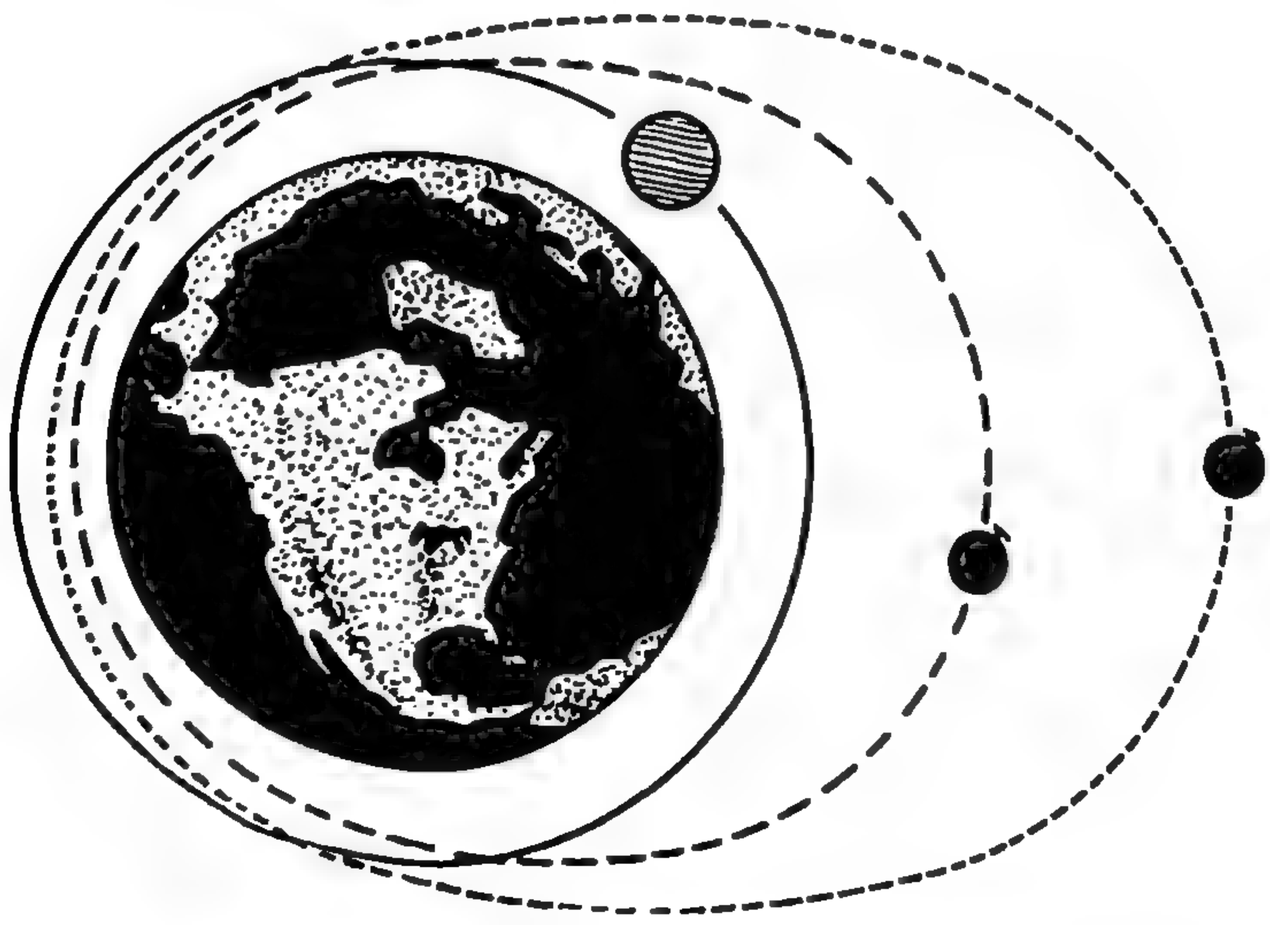
5] With the first launching of a satellite into orbit by the Soviet Union (Sputnik I) in 1957, the real development work on satellite communications began. Shortly thereafter two successful satellites were launched in the United States, Echo I and Telstar I. Echo I proved that signals could be reflected off a *passive* satellite and received several thousand miles away. Telstar I proved that an *active* satellite could send telephone calls and live television [4] across the ocean.

6] Echo I, a passive satellite, was launched into orbit in 1960. A 100-foot inflated balloon coated with aluminum, Echo I could easily be seen by the naked eye.[5] Still in orbit, Echo I is now wrinkled and deflated. Though it is no longer in use, it has been of great importance. For it demonstrated for the first time that a passive satellite (that is, one that simply acts like a mirror to reflect the signals it receives from earth) would work.



7] Telstar I, an active satellite, was launched in 1962. By means of this 170-pound satellite, high-quality television was transmitted between a ground station in Maine and similar stations in England and France during the first day of operation. Unlike the earlier Echo I, this satellite did not serve as a mere reflector. Rather, it amplified the signals it received and sent them back on a different frequency to other points on the earth.

8] While Telstar I was experimental, Telstar II, launched in 1963, was a practical, working means of communication in our modern world. With Telstar II, satellite communications was no longer a dream of brilliant scientists. It had become a reality right in our own living rooms.



The orbits of Echo I, Telstar I, and Telstar II

INTENSIVE QUESTIONING: *Yes-No* Questions

1. Do microwaves differ from radio waves? Yes, they do.
2. Do microwaves have a higher frequency? _____
3. Do they have a lower frequency? _____
4. Does frequency mean rate of vibration per second? _____
5. Are microwaves used in sending telephone calls? _____
6. Can television programs be sent with microwaves? _____
7. Do microwaves give high-quality performance? _____
8. Do they have a small message capacity? _____
9. Can high-frequency waves travel unlimited distances? _____
10. Can high-frequency waves bend? _____
11. Can high-frequency waves travel in curves? _____
12. Does the curvature of the earth limit their path? _____
13. Are relay towers needed every 30 miles? _____
14. Do microwaves travel in curved lines? _____
15. Is it possible to build towers across an ocean? _____
16. Did Arthur C. Clarke propose that a satellite could relay signals? _____
17. Is Clarke an American scientist? _____

INTENSIVE QUESTIONING: *Or* Questions

1. Do microwaves have a high frequency or a low frequency? They have a high frequency.
2. Is frequency rate of vibration per second or per minute?

_____

3. Are microwaves used routinely or rarely for telephone calls?

_____

4. Do they have high-quality performance or low-quality performance?

_____

5. Can they carry one message or many messages at the same time?

_____

6. Do microwaves travel in curves or in straight lines?

_____

7. Are relay towers needed every 30 miles or every 60 miles?

_____

INTENSIVE QUESTIONING: *Wh* Questions

1. What is the difference between microwaves and ordinary radio waves?
   Microwaves have a higher frequency.
2. What are microwaves used for today?

   _____

3. What kind of performance do they give?

   _____

4. How many messages can they carry at the same time?

   _____

5. How do high-frequency waves travel?

   _____

6. What limits the microwave's line-of-sight path?

   _____

7. What distance is the path limited to?

   _____

8. How many miles is the path limited to?

   _____

9. What does good reception require?

   _____

10. How far apart are the relay towers?

    _____

11. How could we send microwave messages long distances?

    _____

12. Who proposed that a satellite might relay signals?

    _____

13. When did Clarke make his proposal?

    _____

14. What did Clarke propose?

    _____

15. What might a satellite be used for?

    _____

16. What idea seemed fantastic in 1945?

    _____

17. When was Sputnik I launched into orbit?

    _____

18. What did John R. Pierce make a study of?

    _____

Understanding Ideas

1. What are the limitations of the usual pathways for long-distance communication? (paragraph 1)

2. What is the difficulty in using microwaves in overseas communications? (paragraph 3)

3. What are some of the differences between a passive satellite like Echo I and an active satellite like Telstar I?

Applying the Reading

1. Try to name some practical benefits that might result from international transmission of live television programs.

2. What kind of training do you think the scientists who work on communications satellites must have? What subjects must they know about?

Composition

1. It is usually possible to summarize a paragraph in one or two sentences. Here are sample summaries of paragraphs 1 and 2:

   Paragraph 1: *The usual pathways for long-distance communications have not provided all the capacity, speed, or quality we need.*

   Paragraph 2: *The communications satellite doesn't require new technical knowledge because it can use the microwave radio relay, a device already available.*

   Using the above sentences as models, write similar summaries of the rest of the paragraphs in the reading.

2. It is possible to divide the reading into these five main parts: (1) paragraph 1; (2) paragraphs 2 and 3; (3) paragraph 4; (4) paragraphs 5, 6, and 7; (5) paragraph 8. Try to summarize the content of each of these parts in a sentence or two.

3. Notice how the relationship between paragraphs 5, 6, and 7 is emphasized by repetition of the words *Echo I* and *Telstar I*. These are first mentioned in the second sentence of paragraph 5. Pick out the other four sentences in these paragraphs that begin with *Echo I* or *Telstar I* and write them down. Point out the similarities in construction and wording.

GRAMMAR REVIEW: Object Clauses after *Whether* and *If*

Model: "Is Echo I still orbiting?"
He wants to know whether Echo I is still orbiting.
He wants to know if Echo I is still orbiting.

12.1 Follow the model as you make clauses with *whether* and *if*.

1. "Are live television broadcasts being relayed by Telstar II?"
   I want to know whether _____
   I want to know if _____
2. "Will there be a live broadcast from Paris tonight?"
   I wonder whether _____
   I wonder if _____
3. "Can a satellite be seen with the naked eye?"
   He is asking me whether _____
   He is asking me if _____
4. "Are satellites practical?"
   We must know _____
   We must know _____
5. "Can a single satellite relay signals to every country?"
   I'm going to ask _____
   I'm going to ask _____
6. "Do satellites use microwaves?"
   They are wondering _____
   They are wondering _____
7. "Is it expensive to launch a satellite?"
   Have you ever wondered _____
   Have you ever wondered _____
8. "Was Telstar I a dramatic success?"
   I need to know _____
   I need to know _____
9. "Are there many books about satellites?"
   I want to find out _____
   I want to find out _____
10. "Can he explain what an orbit is?"
    I wonder _____
    I wonder _____

From Object Clauses to Infinitive Phrases

Model: How much should I write about Telstar?
He wants to know how much he should write about Telstar.
He wants to know how much to write about Telstar.

12.2 Follow the model as you supply a noun clause and an infinitive phrase. Make any necessary changes in the pronouns.

1. "How can I go from here to the television station?"
The student wants to know _____
_____

2. "When should we turn on the program?"
Please tell them _____
_____

3. "Which channel should I watch?"
Can you tell me _____
_____

4. "What kind of television set should we buy?"
We must find out _____
_____

5. "Where can I get a model of a satellite?"
The boy is asking _____
_____

6. "Which station should I call?"
I can't remember _____
_____

7. "Where should I look for a book about satellites?"
I need to know _____
_____

8. "Who can I ask about their history?"
Do you know _____
_____

9. "How can I explain the importance of space communication?"
I wonder _____
_____

10. "Who should I see for more information on Echo I?"
I am going to find out _____
_____

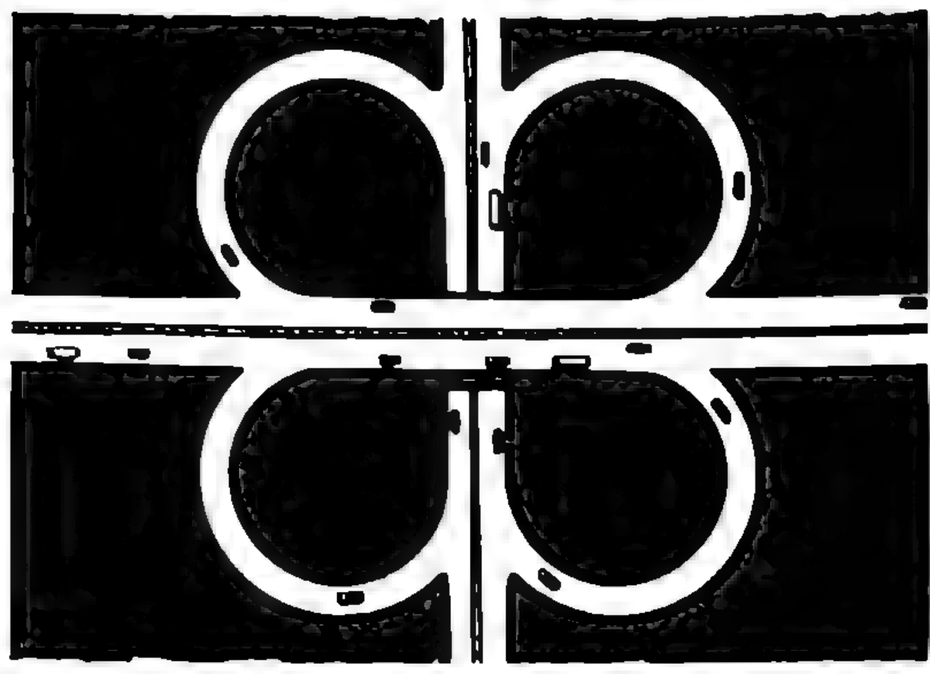
Unit 4: OUR CHANGING LANDSCAPE

Supermarkets

Shopping centers

Mobile homes

Superhighways



Thirteen: SUPERMARKETS

Buying all the food you need in one store

In the check-out line

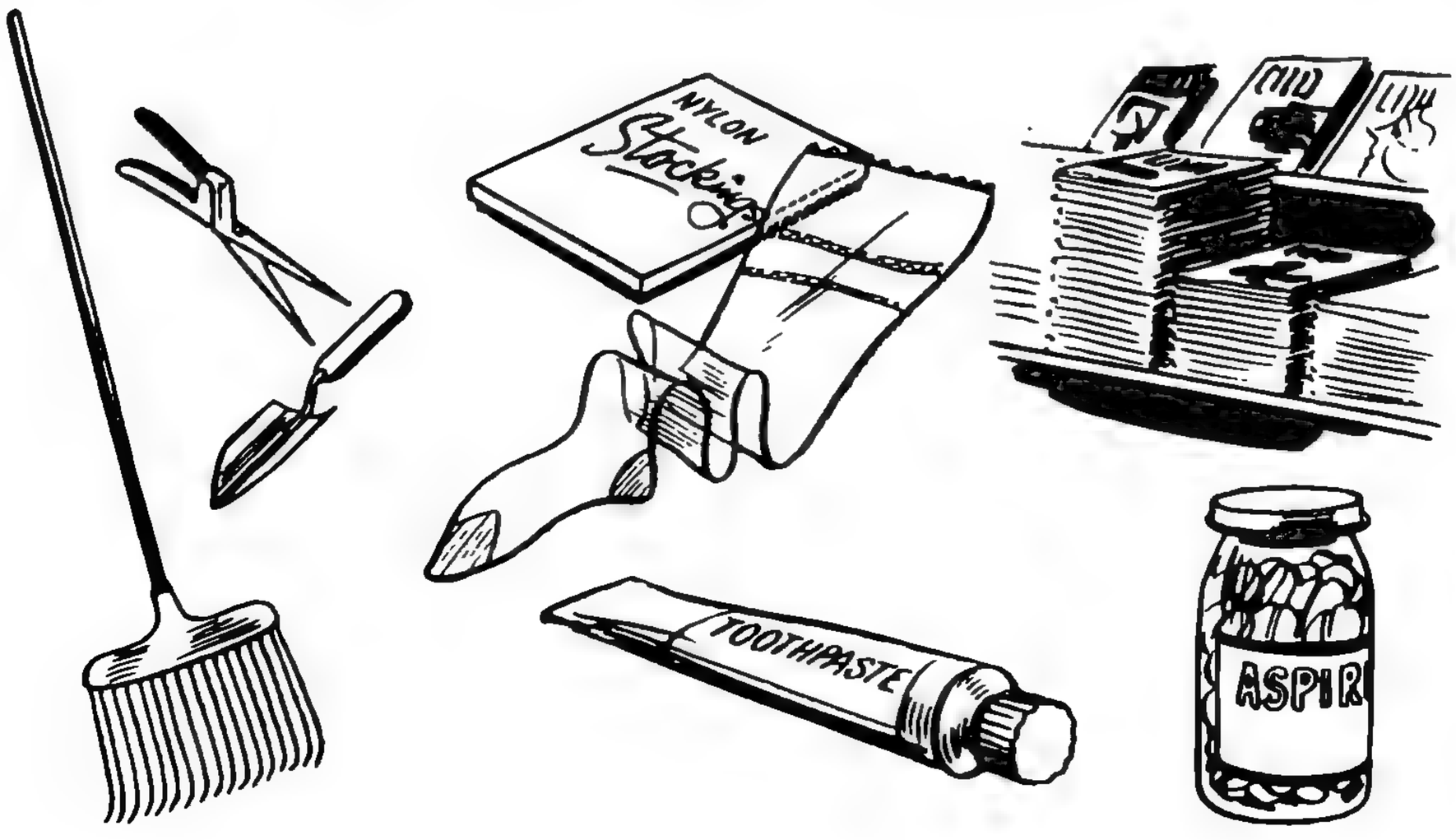
1] Mrs. Ruth Jones walked into the supermarket at 3:00 on Friday afternoon and passed through the check-out line [1] at 3:30. During her half hour in the store, while walking from aisle to aisle, she had passed by nearly 7,000 different items and had bought twenty-three of them, from the week's meat supply to the lettuce and tomatoes that would be put in today's salad.

2] Years of trial and error [2] had taught her how to buy. She had squeezed the tomatoes to be sure they were not too ripe. She had bought her canned goods in multiples of two or three or six to save a penny here and there.[3] At the meat counter she had looked at the large display of packaged meats, and then she had rung a bell for the butcher [4] to help her choose from among them. She wanted to be sure they were as free of fat and bone on the underside as they were on top.[5] Every item in her cart had been chosen with care.

3] Ruth Jones is typical of millions of other housewives in the United States. From the time the supermarkets open in the morning until they close at night, their aisles are crowded with women shoppers, each pushing a cart as she fills it with groceries. But the carts not only have groceries in them. They also contain toothpaste, headache pills, garden tools, magazines, and even nylon stockings. The supermarket tries to meet the housewife's every need [6] so that when she leaves, she'll shop nowhere else.

4] In order to attract and keep their customers, supermarkets have tried to make shopping as pleasant as possible. Some of them have flowers and trees in the parking lots. Some have roofs over the walks so that the shoppers can walk from their cars to the store without having to worry about snow or rain or hot sun. Some have fronts that are made with colorful marble and tile, and inside walls that are painted in soft colors. Ceilings are sometimes soundproofed, and music is piped in.[7] Special spotlights make meat and vegetable displays more attractive. And most of the stores are air-conditioned.

5] With these and other improvements, supermarkets have steadily become more popular. But their popularity is not limited to the United States. From Bangkok to Buenos Aires, the old-style grocery store is fast disappearing. In Europe supermarkets have flourished since 1957. In 1964, Milan and Florence each had eight "Americano Stores." It is predicted that by 1957 there will be 5,000 supermarkets in England. There's no doubt about it [8]—more and more housewives around the world will soon be standing in check-out lines.



Understanding Ideas

1. How much did Ruth Jones accomplish during her half hour in the supermarket? (paragraphs 1 and 2)

2. What can you buy in a supermarket besides groceries? (paragraph 3)

3. What are some of the changes that have been made in supermarkets? (paragraph 4)

Composition

1. Discuss the organization of the reading in class. It might help if you begin by dividing the paragraphs into the following four groups:

   a. paragraphs 1 and 2
   b. paragraph 3
   c. paragraph 4
   d. paragraph 5

2. Use the class discussion as a basis for writing a summary of the reading.

Applying the Reading

1. In your country, when is the biggest meal of the day, at noon or in the evening? At how many places does the average housewife need to shop in order to buy the food for this meal? Does it take a lot of time for her to shop?

2. If there were a supermarket near you, what kinds of food would you like to find in it? Are there some foods popular in other countries that you would like to try?

3. Suppose a housewife bought a week's supply of food at one time. Which of the foods she bought would be perishable? How would she be able to keep them fresh?

GRAMMAR REVIEW: Relative Clauses: *Who* as Subject

Model: The man is called the manager.
The man runs the store.
. . . who runs the store.
The man who runs the store is called the manager.

13.1 Follow the model as you construct sentences with *who* clauses.

1. The boys are called baggers.
   The boys put the groceries in paper bags.
   . . . who _____
   The boys _____
2. The men are called butchers.
   The men cut the meat.
   . . . who _____
   The men _____
3. The girl works in the bakery.
   The girl lives next door to us.
   . . . who _____
   The girl _____
4. The women shop during the evening.
   The women have jobs.
   . . . who _____
   The women _____
5. The women must buy a lot of groceries.
   The women have big families.
   . . . who _____
   The women _____
6. A housewife must shop carefully.
   A housewife wants to save money.
   . . . who _____
   A housewife _____
7. Housewives can save money.
   Housewives check prices carefully.
   . . . who _____
   Housewives _____
8. Those housewives can shop once a week.
   They have freezers.
   . . . who _____
   Those housewives _____

Relative Clauses: ϕ, *That*, and *Whom* as Direct Objects

Model: The man is the butcher.
You saw the man behind the counter.
The man you saw behind the counter is the butcher.
The man that you saw behind the counter is the butcher.
The man whom you saw behind the counter is the butcher.

13.2 Write three sentences with relative clauses. Use nothing (ϕ), *that*, and *whom*.

1. The girl works at the bakery.
   We met the girl yesterday.
   The girl _____
   The girl _____
   The girl _____
2. The man is the manager.
   You should ask the man.
   The man _____
   The man _____
   The man _____
3. The clerk is really very honest.
   She doesn't trust the clerk.
   The clerk _____
   The clerk _____
   The clerk _____
4. The boy has never worked before.
   They are hiring the boy.
   The boy _____
   The boy _____
   The boy _____
5. The manager is being transferred to another store.
   We like the manager.
   The manager _____
   The manager _____
   The manager _____
6. Many students work at the supermarket after school.
   We know them.
   Many students _____
   Many students _____
   Many students _____

Relative Clauses: *Whom*, *That*, and ϕ as Objects of Preposition

Model: The man to whom you spoke is the manager.
The man that you spoke to is the manager.
The man you spoke to is the manager.

13.3 For writing only. Follow the model and write two other sentences.

1. The clerk for whom we were looking wasn't in the store.

2. The butcher about whom you asked doesn't work there anymore.

3. The woman by whom she was standing dropped her purse.

4. We like to trade with a man in whom we have confidence.

5. The people near whom we live shop at the same supermarket.

6. The butcher on whom my mother relies is on vacation.

7. The neighbor with whom my mother shops told us about the sale.

8. The man from whom I borrowed the money is my neighbor.

9. The clerk on whom we depended was transferred to another store.

10. The man with whom I usually drive to work is home ill today.

Relative Clauses: *That* as Subject

Model: The counter has frozen foods.
The counter is in the front of the store.
. . . that is in the front of the store.
The counter that is in the front of the store has frozen foods.

13.4 Follow the model as you construct sentences with *that* clauses.

1. The canned goods are on the top shelf.
   The canned goods are on sale.
   . . . that _____
   The canned goods _____
2. The counters are refrigerated.
   The counters are filled with meat.
   . . . that _____
   The counters _____
3. The meat is excellent.
   The meat is sold at the supermarket nearby.
   . . . that _____
   The meat _____
4. The vegetables keep fresh.
   The vegetables are sprayed with water.
   . . . that _____
   The vegetables _____
5. The cakes don't get dry.
   The cakes are wrapped in cellophane.
   . . . that _____
   The cakes _____
6. The milk comes in cartons.
   The milk is delivered to our door.
   . . . that _____
   The milk _____
7. We like the milk.
   The milk comes from Don's dairy.
   . . . that _____
   We like _____
8. There's the truck.
   The truck carries the milk to town.
   . . . that _____
   There's _____

Relative Clauses: ϕ, *That*, and *Which* as Direct Objects

Model: We like the milk.
We buy the milk from Don's dairy.
We like the milk we buy from Don's dairy.
We like the milk that we buy from Don's dairy.
We like the milk which we buy from Don's dairy.

13.5 Follow the model as you write three sentences with relative clauses.

1. The brand is inferior.
The store puts the brand on sale.
The brand _____
The brand _____
The brand _____
2. The vegetables keep fresh.
They spray the vegetables with water.
The vegetables _____
The vegetables _____
The vegetables _____
3. The cakes don't get dry.
They wrap the cakes in cellophane.
The cakes _____
The cakes _____
The cakes _____
4. The meat is excellent.
This store sells the meat.
The meat _____
The meat _____
The meat _____
5. The bread is stale.
They put the bread on a special shelf.
The bread _____
The bread _____
The bread _____
6. The oranges are from California.
You are eating the oranges.
The oranges _____
The oranges _____
The oranges _____

Which, *That*, and ϕ as Objects of Preposition

Model: The store with which we trade is quite reliable.
The store which we trade with is quite reliable.
The store that we trade with is quite reliable.
The store we trade with is quite reliable.

13.6 Follow the model and write three other sentences.

1. This isn't the brand for which I asked.

2. That's the exit by which the customer left.

3. The supermarket in which she works has a good bakery.

4. The street on which the store is located has heavy traffic.

5. The store at which we shop is having a big sale.

6. The brand for which we were looking was sold out.

13.7 Make sentences using the following table.

The supermarket The grocery store The meat market	that	she shops in he bought they work in	is being remodeled. is going out of business. is on Main Street.

Fourteen: SHOPPING CENTERS

Everything for the shopper's needs

A covered mall

1] It was a windy winter day in New Jersey. Yet in the central mall of the Cherry Hill Shopping Center, tiny children were playing around a fountain, putting their hands into the splashing spray. Nearby their mothers watched from benches, unconcerned with the cold. For this was one of the amazing new shopping centers with enclosed malls that are warm in winter, cool in summer. In the mall, which stretches for a third of a mile past seventy-five stores and shops, people were lunching in a sidewalk café, looking out upon palm trees and a 20-foot-high aviary alive with[1] tropical birds.

2] Along with motels, express highways, and supermarkets, shopping centers represent a conspicuous change in our modern landscape.[2] A dozen years ago there were only about a hundred shopping centers in the United States. Today the total comes to[3] around seven thousand.

3] Shopping centers have developed from a number of causes—the great shift of population to the suburbs, the growing use of and dependence upon the automobile, and the heavy traffic in downtown areas.[4] The first centers were nothing more than[5] a group of neighborhood stores, built around a supermarket, with a little off-street parking space. The next step was a strip of stores[6] set back from[7] a street or highway with a common parking area in front. Then came the giant shopping centers, surrounded by parking areas, with scores of stores facing a huge central mall. Finally the mall was enclosed completely, and heating and air conditioning were added.

4] A shopping center tries to provide all the goods and services that a customer could ask for. In a single visit to Northland, a huge shopping center near Detroit, a family can get the week's food supply, get haircuts, take out insurance, arrange a world tour, get medical examinations, have a tooth pulled, obtain the latest stock quotations,[8] have typing done, enroll in bridge and sewing classes, have eyes examined, prescriptions filled, clothes washed or cleaned, pictures taken, watches repaired, and shoes shined.

5] Shopping centers are springing up [9] in many large cities throughout the world, wherever there are enough automobiles to produce downtown crowding. Most big centers provide three or four times as much space for parking as for the shops themselves. Some parking lots are 75 to 85 acres, with space for as many as 10,000 cars. In any shopping center, the automobile is all-important.

6] Some cities of course have had shopping centers for generations, but have never called them that. In many old cities of Europe, shops follow narrow, twisting streets that lead to a small square with a clock towering high above. All this gives the shopper a sense of discovery and excitement seldom felt in modern shopping centers. Some architects feel that the modern mall is too long and too wide, with too many straight lines. What it needs, they believe, is the "sense of closeness" [10] that one gets in the "walking street" of Copenhagen's Strøget, in the "walkway" of Venice, or in the colorful covered bazaars of the Near East and North Africa. No doubt planners of modern shopping centers have much to learn [11] from these older and well-known centers for shopping.

A covered bazaar

The "walkway" of Venice

Understanding Ideas

1. What are some of the reasons for the development of shopping centers? What are the steps in their development? (paragraph 3)

2. What could you do during a single visit to a shopping center? What might you see there besides shops? (paragraph 4)

Composition

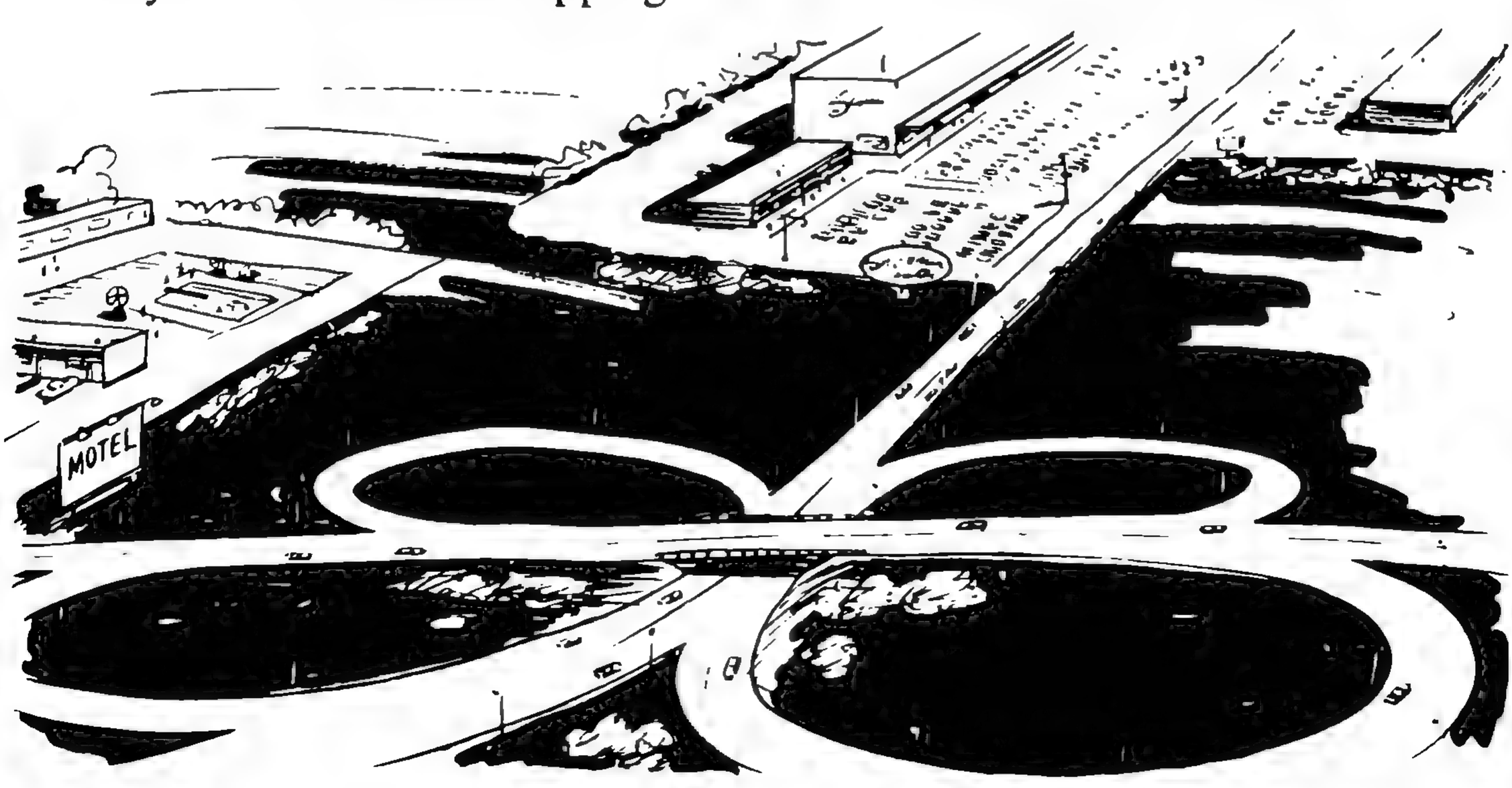
Write a short composition based on paragraph 4. Begin it with the following topic sentence: *People who work in shopping centers have many different kinds of jobs.*

Applying the Reading

1. What are your "centers for shopping" like? Do you have market-places? Village squares? A number of small neighborhood shops?

2. If you could plan your own modern shopping center, what would you like to have in it? What kinds of shops would you include? What would you include besides shops?

3. Where would you put your shopping center—in the center of the city or in the suburbs? What would happen to the center of the city if most of the shopping centers were built in the suburbs?



GRAMMAR REVIEW: Relative Clauses: *Whose* + Noun as Subject

Model: That's the girl.
The girl's father works at the shopping center.
. . . whose father works at the shopping center.
That's the girl whose father works at the shopping center.

14.1 Follow the model to construct sentences using *whose.*

1. The woman wrecked her car.
The woman's husband sells car insurance.
. . . whose husband _____
_____

2. The man sells insurance.
His car was wrecked.
. . . whose car _____
_____

3. The little girl told us about it.
Her father saw the accident.
. . . whose father _____
_____

4. The man is my neighbor.
His store burned down.
. . . whose _____
_____

5. The woman had to call her husband.
Her keys were locked in the car.
. . . whose _____
_____

6. The woman lives near us.
Her husband is a butcher in the supermarket.
. . . whose _____
_____

7. The man manages the supermarket.
The man's wife just spoke to us.
. . . whose _____
_____

Relative Clauses: *Whose* + Noun as Direct Object

Model: The policeman gave her a ticket.
She hit the policeman's car.
She hit whose car . . .
. . . whose car she hit.
The policeman whose car she hit gave her a ticket.

14.2 Follow the model to construct sentences using *whose*.

1. The man manages the supermarket.
   You know his wife.
   You know _____
   . . . _____
   The man _____
2. The girl is my sister.
   You took the girl's picture.
   You took _____
   . . . _____
   The girl _____
3. The man owns a shoe store.
   You just met his daughter.
   You just met _____
   . . . _____
   The man _____
4. The architect lives next door to us.
   You saw his picture in the paper.
   You saw _____
   . . . _____
   The architect _____
5. The author is our neighbor.
   You just bought the author's book.
   You just bought _____
   . . . _____
   The author _____
6. The woman used to work in a bakery.
   You are eating the woman's cake.
   You are eating _____
   . . . _____
   The woman _____

Relative Clauses: *Whose* + Noun as Object of Preposition

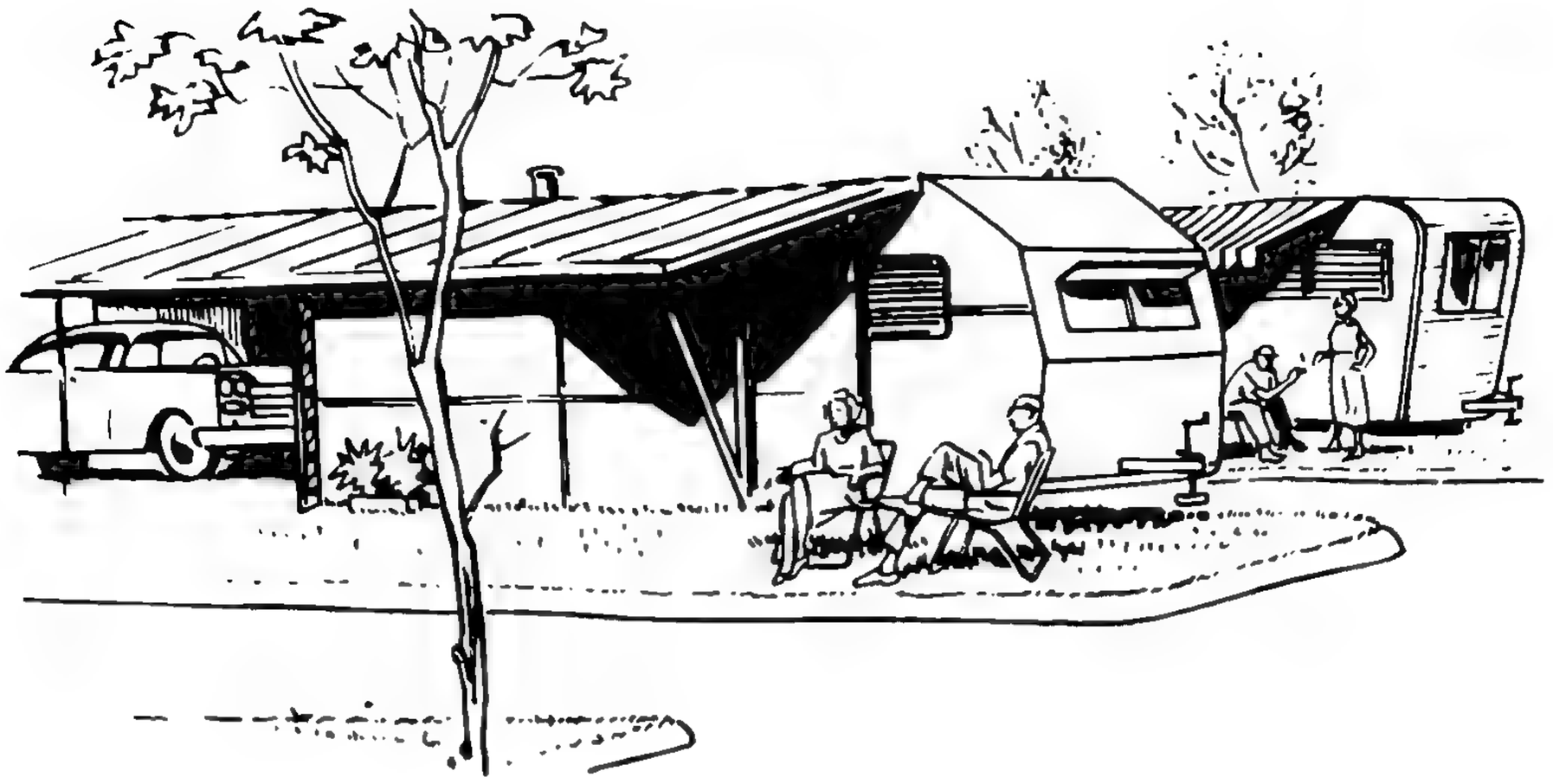
Model: The woman had an accident.
I was riding in the woman's car.
I was riding in whose car . . .
. . . whose car I was riding in.
The woman whose car I was riding in had an accident.

14.3 Follow the model as you construct sentences using *whose*.

1. The man is my neighbor.
   You shop at his store.
   You shop at _____
   . . . _____
   The man _____
2. The girl is my sister.
   You are looking at her picture.
   You are looking at _____
   . . . _____
   The girl _____
3. The man manages the supermarket.
   I was just speaking to the man's wife.
   I was just speaking to _____
   . . . _____
   The man _____
4. The artist is famous.
   You have been asking about his pictures.
   You have been asking about _____
   . . . _____
   The artist _____
5. There's the man.
   We were wondering about the man's name.
   We were wondering about _____
   . . . _____
   There's the man _____
6. There's the girl.
   You used to work with the girl's father.
   You used to work with _____
   . . . _____
   There's the girl _____

Fifteen: MOBILE HOMES

Living on wheels



1] One of every nine new homes built in the United States is a house on wheels. About four million Americans, many of them elderly retired citizens, now live permanently on wheels. They are not campers by the roadside on a vacation trip. Rather, they are "park dwellers," as they call themselves, living in permanent mobile home "parks" or communities, with attractive landscaping and winding paved streets. Some of these parks have clubhouses, swimming pools, and a shopping center containing a market, a beauty shop,[1] a barbershop, a restaurant, and a laundry.

2] More than 18,000 of these mobile-home parks are scattered all over the United States, from California to Maine, from Florida to Alaska. Some are luxury parks. Others are crowded trailer camps. Between these two extremes are the majority of "good" parks, well-planned, and suited to the pocketbook of [2] the average park dweller.

3] Giving up [3] their fixed houses and apartments, park dwellers have chosen to live in aluminum-covered vehicles propped up on concrete blocks, but required by law in most states to rest partly on their wheels. Too big and too heavy to be pulled behind passenger cars, these mobile homes are moved by tow trucks. But park dwellers don't shift from one trailer park to another. They move on an average of only once in twenty-eight months.[4] Having chosen their mobile community, they are loyal to it. Many of them settle there for good.[5]

4] "It's the life for us!" [6] declares trailer dweller Sam Gibson. The Gibsons, who are retired, live in a mobile home that is expandable. When the trailer is ready for towing, one side is pushed in toward the other, thus making it narrow enough to fit on the highway. When it is parked, the trailer can be opened wide again to make more floor space. The living room is as large as many living rooms in fixed homes. About one-fourth of all new trailer homes are made with pull-out rooms.[7] Some have two or three bedrooms, half a dozen closets, and a kitchen in addition to a large living room.

An expandable mobile home

5] The Gibsons' house on wheels is in a trailer park with space for over 500 mobile homes. Some parks are larger, and many are much smaller. Nearly all of the Gibsons' neighbors are either retired [8] or nearing retirement. They have all shaken loose from [9] the possessions they had gathered through the years and speak enthusiastically of their new freedom: "We like it here," they say. "And any time we want to, we can call a tow truck and go somewhere else."

6] The Gibsons have many friends in the park. Both belong to the bicycle club and ride almost daily over the four miles of winding streets. And both enjoy games and dancing in the clubhouse one or two nights a week. Unlike apartment dwellers in big cities, the Gibsons know their neighbors. "It's the atmosphere of the small town, where everybody says hello," one of their neighbors is fond of saying.

7] Some of the Gibsons' neighbors point to the economy of their living. Compared to the price of a fixed home today, mobile homes are truly economical. Only one of every five buyers [10] pays cash. The others make a down payment [11] and take five to seven or more years to pay the balance.[12] In return for their money they get a home fully equipped with furniture, heating units, and sometimes even air conditioning. All the trailers are covered with metal and are insulated against heat and cold. Facilities for connecting plumbing, telephone, electricity, and fuel lines are supplied by the parks.

8] All types of people make their home in trailers [13]—college students, businessmen, workers whose jobs require them to move frequently, and many retired people like the Gibsons. Once nothing more than a fad, mobile-home living can now be regarded as a permanent American way of life.

The parks provide facilities.

Understanding Ideas

1. How many new homes built in the United States are mobile homes, and how many Americans live in them? What are the parks in which they are located like? (paragraphs 1, 2, and 3)

2. What does the Gibsons' mobile home look like? Why do the Gibsons like their life as park dwellers? (paragraphs 4, 5, and 6)

3. In what ways is a mobile home economical? (paragraph 7)

Applying the Reading

1. Park dwellers move on an average of once every twenty-eight months. And even when they don't move themselves, they often have new neighbors. Would you feel the same toward new neighbors as you would toward neighbors you have lived with all your life?

2. Do you think that park dwellers are as much a part of the community as people who live in fixed houses?

Composition

1. Discuss with your teacher the organization of the reading. It might help if you begin by dividing the paragraphs into the following groups:
   a. paragraphs 1, 2, and 3
   b. paragraphs 4, 5, and 6
   c. paragraph 7
   d. paragraph 8

2. Using the following as your central thought, develop a two-paragraph composition: *Although mobile-home owners can live in a pleasant climate every season of the year, they must give up some of their most satisfying associations.* Work out examples in class that you can use as illustrations. For example, you might discuss the difference in climate between Chicago and southern California. You might also discuss what is meant by "satisfying associations." Your teacher will help you with the words you need.

GRAMMAR REVIEW: Relative Clauses: *Where*

Model: We drove by the lot.
The mobile homes were on display *in that lot.*
. . . where the mobile homes were on display.
We drove by the lot where the mobile homes were on display.

15.1 Follow the model as you construct relative clauses with *where.*

1. The United States is a country.
You can find many mobile homes ***in that country.***
. . . where _____
The United States _____
2. The club needed a room.
It could hold meetings ***in that room.***
. . . where _____
The club _____
3. Do you know the city?
The new mobile homes are being manufactured ***in that city.***
. . . where _____
Do you know _____
4. He lives in a new park.
There's a new swimming pool ***near that park.***
. . . where _____
He lives _____
5. Is there a lake nearby?
We can go boating ***on that lake.***
. . . where _____
Is there a lake nearby _____

Model: We drove by the lot.
The mobile homes were on display *in that lot.*
. . . in which the mobile homes were on display.
We drove by the lot *in which* the mobile homes were on display.
We drove by the lot where the mobile homes were on display.

15.2 Follow the model as you construct relative clauses with preposition + *which* and relative clauses with *where.* Use the paired sentences in 15.1.

Relative Clauses: *When*

Model: The day was bright and sunny.
They moved into the park *on that day*.
. . . when they moved into the park.
The day when they moved into the park was bright and sunny.

15.3 Follow the model as you construct relative clauses with *when*.

1. Sam remembers the winters.
   He used to spend hours shoveling snow ***during those winters.***
   . . . when _____
   Sam remembers _____
2. Friday is the day.
   We are going to join the bicycle club ***on that day.***
   . . . when _____
   Friday _____
3. Winter is the season.
   Many mobile-home owners like to move south ***during that season.***
   . . . when _____
   Winter _____
4. November is the month.
   We have many showers ***during November.***
   . . . when _____
   November _____
5. That was the trip.
   Sam fell off the bicycle ***during that trip.***
   . . . when _____
   That _____

Model: The day was bright and sunny.
They moved into the park on that day.
. . . on which they moved into the park.
The day on which they moved into the park was bright and sunny.
The day when they moved into the park was bright and sunny.

15.4 Follow the model as you construct relative clauses with preposition + *which* and relative clauses with *when*. Use the paired sentences in 15.3.

Restrictive Determiners: *Every, Each, Some, Most, Many, Both,* and *All*

Model: Every mobile home that is in the park has a telephone.

15.5 Complete each sentence with a relative clause of your own.

1. Every mobile-home owner _____
2. Each mobile home _____
3. Each mobile-home owner _____
4. Some mobile homes _____
5. Some mobile-home owners _____
6. Most mobile homes _____
7. Most mobile-home owners _____
8. Many people _____
9. Both Sam's friends _____
10. All parks _____

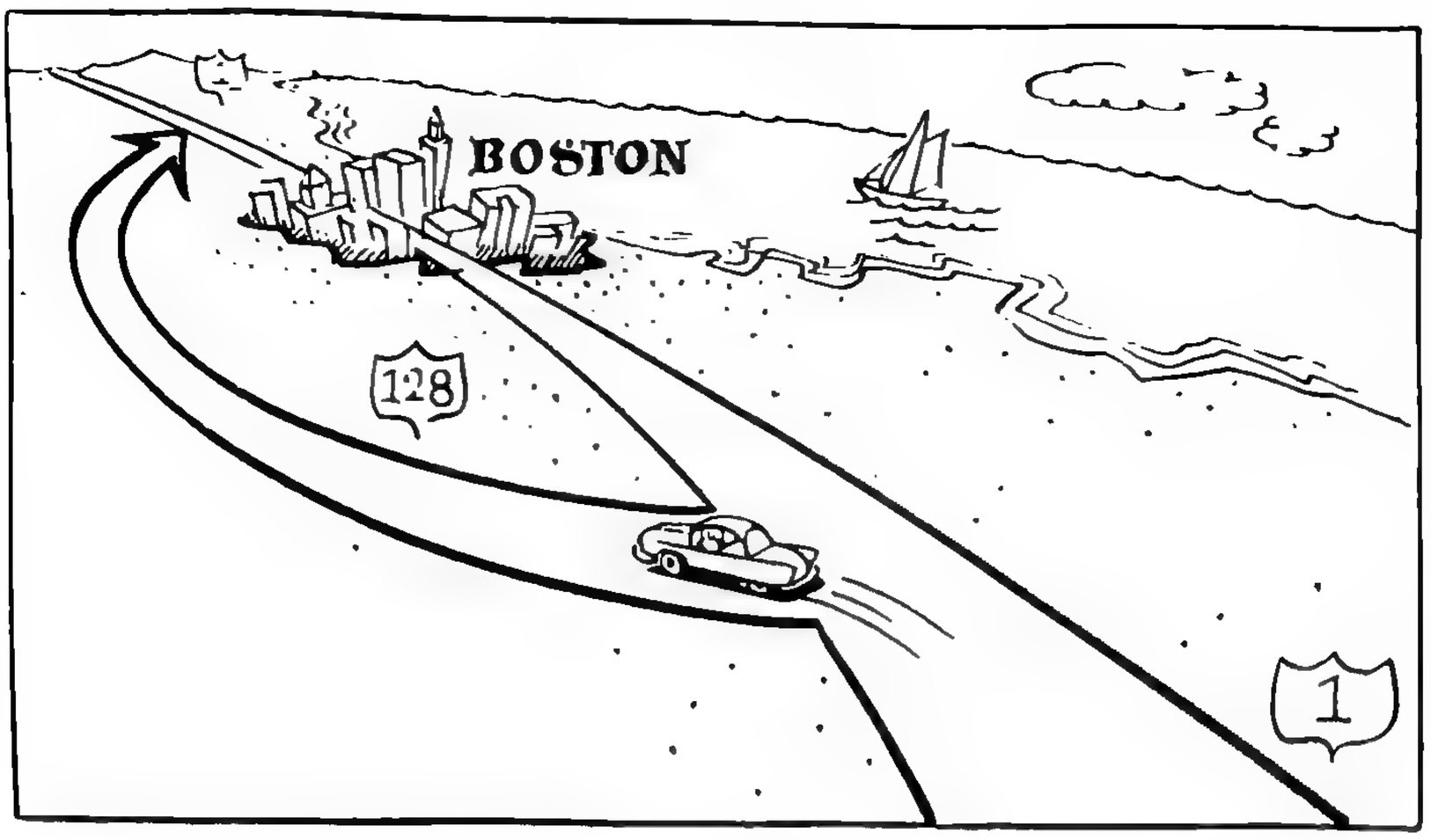
Review of Restrictive Relatives

15.6 Review the relative clauses presented in Lessons Thirteen and Fourteen. Then, using the vocabulary of the readings for these lessons, write relative clauses of your own that represent the following patterns:

	page
1. The men *who work in the supermarket* . . .	116
2. The man *you saw behind the counter* . . .	117
3. The man *to whom you spoke* . . .	118
4. The counter *that has frozen foods* . . .	119
5. She bought the peaches *that she canned.*	120
6. The store *with which we trade* . . .	121
7. That's the girl *whose father works at the shopping center.*	125
8. The policeman *whose car she hit* . . .	126
9. The woman *whose car I was riding in* . . .	127
10. The woman *in whose car I was riding* . . .	127
11. The lot *where the mobile homes were on display* . . .	132
12. The day *when they moved into the park* . . .	133

Sixteen: SUPERHIGHWAYS

Getting there faster and more safely

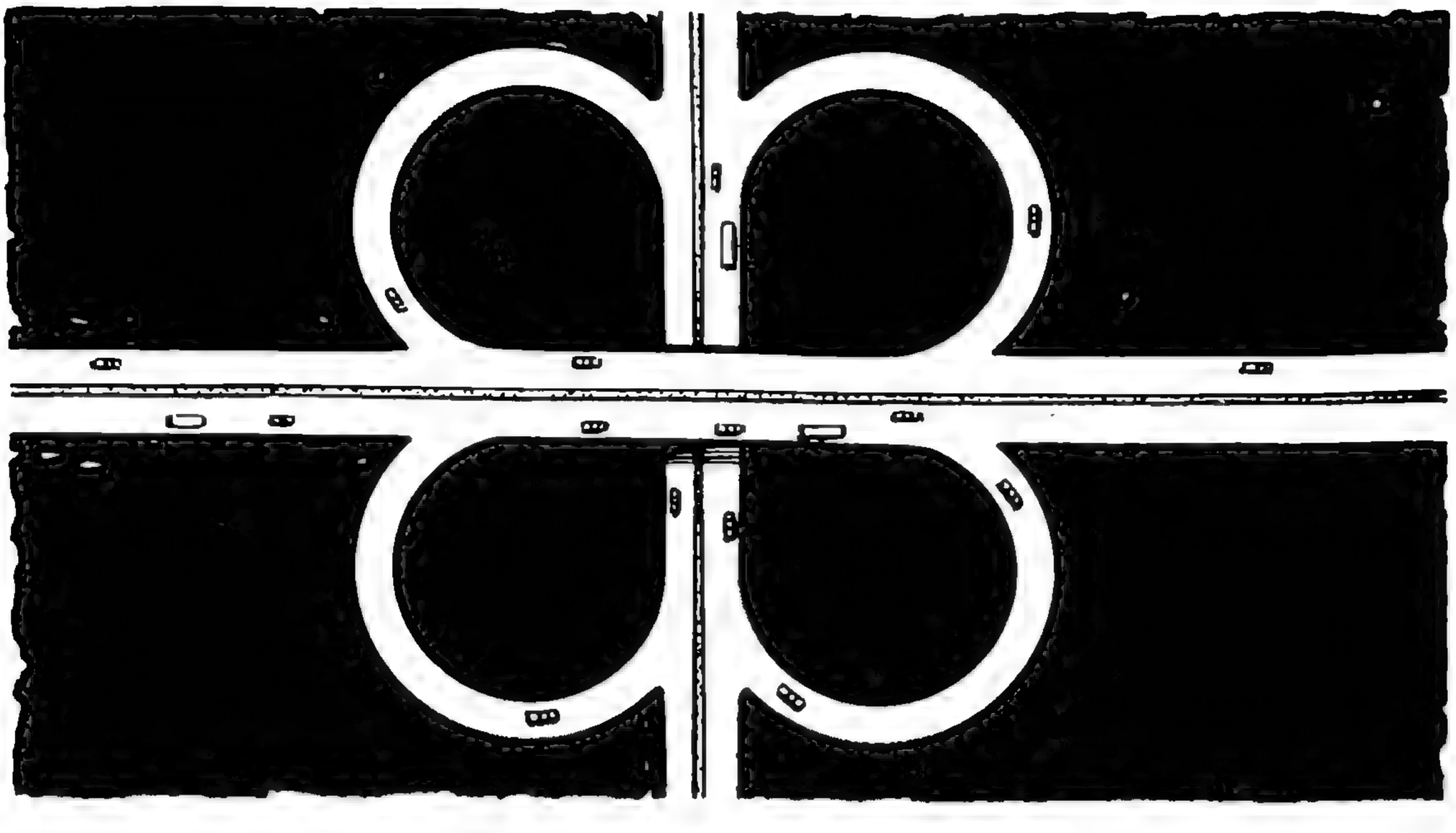


1] One bright sunny morning Mr. Oliver Stockwell, resident of Providence in the state of Rhode Island, drove to a superhighway known as Route 1 and headed north for Portland, Maine.[1] Since this was New England, and since in New England all roads lead to Boston, Route 1 eventually took Stockwell to that city—or it would have, if he had stayed on it. But some 15 miles south of Boston, he left the highway, turned to the west, and drove around the city's outskirts. Minutes later, having completed a semicircle around Boston, Stockwell was back on Route 1, headed toward Portland, with Boston behind him.

2] Stockwell's bypassing of[2] Boston was made possible by another new superhighway known as Route 128. What Route 128 has done is what many similar belt highways are now doing. The Baltimore Beltway around Baltimore, the Capitol Beltway around Washington, D.C., and others—all curve around a big city, forming an outer loop or belt that lets the long-distance driver bypass the downtown areas.

3] But suppose the driver is a commuter who does not want to bypass a city. He works there and he wants to get there in the shortest time possible. Ben Jones is such a man. He lives on the South Side of Chicago, and for years he spent thirty minutes every morning driving to the city to work. When the new expressway[3] was opened in 1962, Ben found he could make the trip in only twelve minutes.

4] This new expressway is only 12 miles long, but it is fourteen lanes wide. There are inner express lanes leading directly to the city and outer local lanes with exits every half mile. At these points drivers can leave the expressway for areas outside the city. Every 1½ miles there are also roads leading onto and off the expressway. What looks like a confused cloverleaf maze from the air is really a 55-mile-an-hour miracle for the man at the wheel of a car.



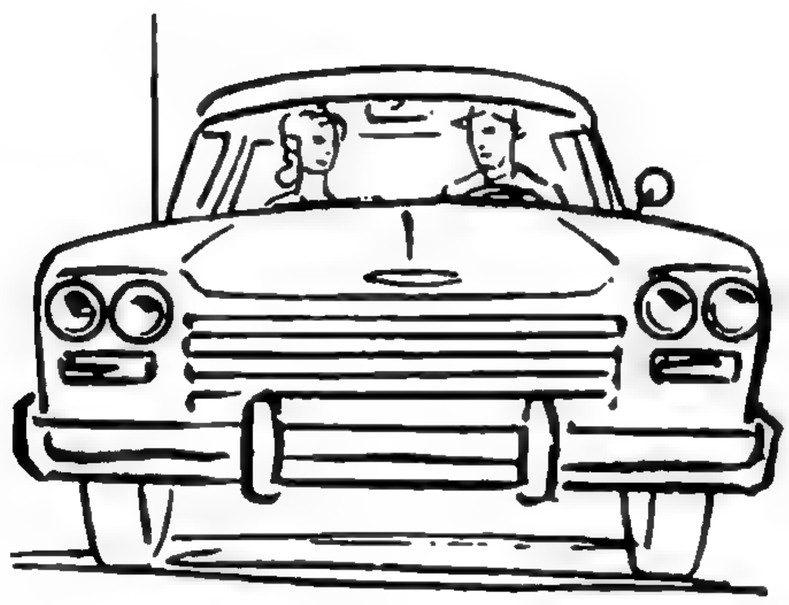
A cloverleaf

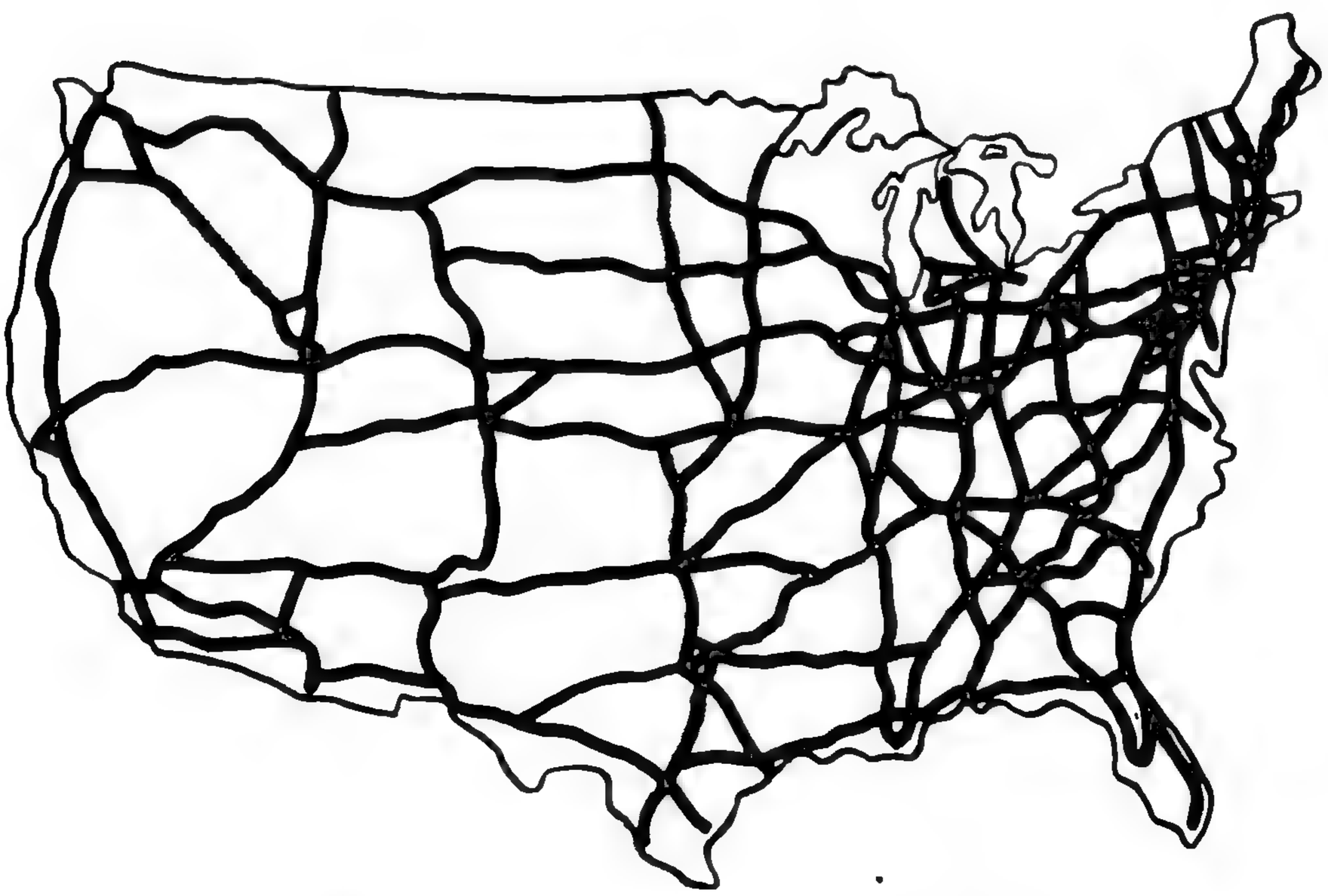
5] Now suppose that Ben Jones is headed not for work but for a vacation. Wherever he decides to go—north, south, east, or west—his travel is speeded by long stretches of the nation's network of superhighways [4] known as the Interstate System.[5] Almost half of this Interstate System was open to traffic [6] in 1964, and all is due to be completed in 1972. When it is finished, the vacationer will be able to drive from one end of the country to the other—from the Atlantic to the Pacific, from Canada to Mexico—without a stop sign, a traffic light, or an intersection.

6] But Ben's vacation needn't be limited to the United States. If he had enough time, he might head north to Canada. One of the highways he might travel on there is Canada's Route 6, a 560-mile highway that loops around the countryside of French-speaking Quebec. Or he could take the Trans-Canadian Highway along the northern shore of Lake Superior. Or he could even take a longer trip to Alaska, where he can now drive to places once reached only by plane.

7] Ben might also, of course, head south. If he did, he would soon find himself on one of the famous superhighways that cross the Mexican border at more than half a dozen principal points from the Gulf of Mexico on the east to the Pacific Ocean on the west. The oldest route, the one that Ben would probably take in traveling south from Chicago, crosses the border at Laredo, Texas. In twenty-one hours of driving time Ben would be in Mexico City.

8] South of Mexico City all of the international roads from the north come together and continue to Guatemala. Roads that will eventually be part of a Pan-American System are now being built through the other countries of Central America and into Colombia. Ben's son, if not Ben himself, might someday be able to drive from Bogotá to Anchorage on a single chain of modern superhighways.





A map of the Interstate Highway System

Understanding Ideas

1. What are belt highways? What is their purpose? (paragraphs 1 and 2)

2. Why do commuters want superhighways? Describe the expressway on which Ben Jones drives to work. (paragraphs 3 and 4)

3. Using the superhighway map on page 137, name some of the cities Ben would travel through if he went from Chicago to Mexico City.

Applying the Reading

1. What does your country rely on for transportation? Does it rely mainly on roads, rivers, or railway systems? What are the geographical features (e.g., rivers, mountains) that influence the transportation system in your country?

2. What vehicles other than private cars make use of the highways in your country? What do these vehicles transport?

3. What are the six largest cities in your country? Describe the roads that connect them.

Composition

1. Discuss with your teacher the organization of the reading. It might help if you begin by dividing the paragraphs into the following groups:
   a. paragraphs 1 and 2
   b. paragraphs 3 and 4
   c. paragraphs 5, 6, 7, and 8

2. Using the following topic sentence, develop a two-paragraph composition: *Superhighways give us speed and safety, but tourists would be foolish to use them exclusively.* Work out examples in class that you can use as illustrations. In what ways do superhighways give us speed and safety? What would tourists miss if they limited their trips to superhighways (including belt highways around the cities)?

GRAMMAR REVIEW: Nonrestrictive Clauses: *Who* as Subject

Model: My father drives to work with Ben Jones.
Ben Jones lives next door to us.
. . . who lives next door to us.
My father drives to work with Ben Jones, who lives next door to us.

16.1 Follow the model as you construct nonrestrictive clauses with *who* as subject. Be sure to put a comma before the *who* clause.

1. Near the expressway they pick up Nat Hale.
   Nat Hale is a friend of Ben Jones's.
   . . . who _____
   Near _____
2. In the car behind him one morning my father saw his favorite policeman.
   The policeman seemed to be watching him.
   . . . _____
   In the car _____
3. At the exit to the business district the policeman stopped my father.
   My father had been driving very fast.
   . . . who _____
   At the exit _____
4. My father turned to Ben Jones.
   Ben Jones always looks very impressive.
   . . . _____
   My father _____
5. My father said, "This is Mr. Jones."
   "Mr. Jones will explain why we were driving fast."
   . . . _____
   My father said _____
6. Ben Jones tried to impress the policeman.
   The policeman ignored him and went on writing the ticket.
   . . . _____
   Ben Jones _____
7. The policeman gave the ticket to my father.
   My father accepted it meekly and drove off.
   . . . _____
   The policeman _____

Model: My oldest son drives home with a friend every Christmas.
My oldest son goes to school in Ohio.
. . . who goes to school in Ohio.
My oldest son, who goes to school in Ohio, drives home with a friend every Christmas.

16.2 Follow the model as you construct nonrestrictive clauses with *who*. Be sure to set off the *who* clauses by commas.

1. My son's friend lives in Wisconsin.
His friend owns the car.
. . . who _____
My son's friend, _____
2. Sometimes Jim Jackson rides home with them.
Jim Jackson lives in Indiana.
. . . who _____
Sometimes Jim Jackson, _____
3. Last Christmas Jim Jackson went to sleep when they were halfway home.
Jim Jackson was riding in the back seat.
. . . who _____
_____
4. My son was talking very excitedly to his friend.
My son was driving.
. . . who _____
_____
5. Neither he nor his friend remembered Jim.
His friend is usually very thoughtful.
. . . who _____
_____
6. Jim was eager to get home on time.
Jim had a date that night.
. . . who _____
_____
7. My son suddenly noticed that he had passed Jim's town.
My son had promised to take Jim to his door.
. . . who _____
_____

Nonrestrictive Clauses: *Whom* as Direct Object

Model: My father sometimes drives to work with Ben Jones.
He has known Ben Jones for years.
. . . he has known whom for years.
. . . whom he has known for years.
My father sometimes drives to work with Ben Jones, whom he has known for years.

16.3 Follow the model as you construct nonrestrictive clauses with *whom* as direct object. Set the clauses off by commas.

1. Near the expressway they pick up Nat Hale.
You met Nat Hale at our house last night.
. . . you met whom _____
. . . whom you met _____
Near _____
2. In the car behind him one morning my father saw Sam the policeman.
He knew Sam very well.
. . . he knew whom _____
. . . whom he knew _____
In the car _____
3. The policeman recognized my father.
He had warned my father several times about driving too fast.
. . . he had warned whom _____
. . . whom he had warned _____
The policeman _____
4. Nat Hale was sitting beside my father.
The policeman had also stopped Nat Hale for speeding.
. . . the policeman had also stopped whom _____
. . . whom the policeman _____
Nat Hale, _____
5. Ben Jones was in the back seat.
The policeman had never seen Ben Jones before.
. . . the policeman had never seen whom _____
. . . whom the policeman _____
Ben Jones, _____

Nonrestrictive Clauses: *Whom* as Object of Preposition

Model: Ben Jones is a highway engineer.
My father often drives to work with Ben Jones.
My father often drives to work with whom . . .
. . . with whom my father often drives to work.
Ben Jones, with whom my father often drives to work, is a highway engineer.

16.4 Follow the model as you construct nonrestrictive clauses with *whom* as object of the preposition. Remember that nonrestrictive clauses are set off by commas.

1. Nat Hale also rides to work with them.
   You were introduced to Nat Hale last night.
   You were _____
   . . . to whom _____
   Nat Hale, _____
2. In the car behind them one morning was a friendly policeman.
   My father had often spoken to the policeman before.
   My father had _____
   . . . to whom _____
   In the car _____
3. The policeman recognized my father.
   He had given several traffic tickets to my father.
   He had _____
   . . . to whom _____
   The policeman _____
4. Nat Hale was sitting beside my father.
   The policeman had great respect for Nat Hale.
   The policeman _____
   . . . for whom _____
   Nat Hale _____
5. Ben Jones was sitting in the back seat.
   The policeman knew nothing about Ben Jones.
   The policeman _____
   . . . about whom _____
   Ben Jones _____

Nonrestrictive Clauses: *Which* as Subject

Model: We don't like the noise from the North Expressway.
The North Expressway runs near our house.
. . . which runs near our house.
We don't like the noise from the North Expressway, which runs near our house.

16.5 Construct nonrestrictive clauses with *which* as subject.

1. For dinner they stopped at the Last Chance Inn.
   The Last Chance Inn is a restaurant beside an old bridge.
   . . . which _____
   For dinner _____
2. Slow drivers should avoid inside lanes.
   Inside lanes are always reserved for faster traffic.
   . . . which _____
   Slow drivers _____
3. Cars cannot park except on special shoulders.
   The shoulders have been built every mile or so along the highway.
   . . . which _____
   Cars cannot _____
4. The woman was standing by her car.
   The car looked as if it had a flat tire.
   . . . which _____
   The woman _____
5. The driver of the wrecked truck had lit three flares.
   The flares are small lights to warn approaching traffic.
   . . . which _____
   The driver _____
6. There are many accidents at the Oak Park exit.
   The Oak Park exit is very narrow.
   . . . which _____
   There are _____
7. In the winter we avoid the Outer Drive.
   The Outer Drive is often blocked by snow.
   . . . which _____
   In the winter _____

Nonrestrictive Clauses: *Which* as Direct Object

Model: The North Expressway is one of the best in the country.
Ben Jones helped to design the North Expressway.
Ben Jones helped to design which . . .
. . . which Ben Jones helped to design.
The North Expressway, which Ben Jones helped to design, is one of the best in the country.

16.6 Construct nonrestrictive clauses with *which* as direct object.

1. For dinner they stopped at the Last Chance Inn.
They reached the Last Chance Inn after driving all day.
They reached _____
. . . which _____
For dinner _____
2. Slow drivers should avoid inside lanes.
Regulations always set the inside lanes aside for fast traffic.
Regulations _____
. . . which _____
Slow drivers _____
3. Cars cannot be parked except on special shoulders.
You can see the special shoulders every mile or so along the highway.
You can _____
. . . which _____
Cars cannot _____
4. A woman was standing beside her new car.
The policeman had stopped the new car because it had no license.
The policeman _____
. . . which _____
A woman _____
5. The driver of the wrecked truck had lit three flares.
Approaching drivers would recognize the flares as warnings.
Approaching drivers _____
. . . which _____
The driver _____

Nonrestrictive Clauses: *Which* as Object of Preposition

Model: The fastest route to town is the North Expressway.
You can always see a lot of traffic on the North Expressway.
You can always see a lot of traffic on which . . .
. . . on which you can always see a lot of traffic.
The fastest route to town is the North Expressway, on which you can always see a lot of traffic.

16.7 Follow the model as you construct nonrestrictive clauses with *which* as object of the preposition. Be sure the clauses are set off by commas.

1. The newest bridge collapsed in the storm.
   We had driven over the newest bridge many times.
   We had _____
   . . . over which _____
   The newest bridge, _____
2. They are putting new signs along the North Expressway.
   There have been many accidents on the North Expressway.
   There have _____
   . . . on which _____
   They are putting _____
3. The new tunnel will be a mile long.
   Special concrete must be used in the new tunnel.
   Special concrete _____
   . . . in which _____
   The new tunnel, _____
4. He kept looking up at his rear-view mirror.
   He could see a police car through the rear-view mirror.
   He could _____
   . . through which _____
   He kept _____
5. Three flares warned the oncoming cars.
   The driver stood all night long by the flares.
   The driver _____
   . . . by which _____
   Three flares, _____

Review of Nonrestrictive Clauses

16.8 Review the nonrestrictive clauses in Lesson Sixteen. Then, using the vocabulary of the readings for Unit 4, write nonrestrictive clauses of your own to illustrate the following:

1. *Who* as subject:
   My father drives to work with Ben Jones, who lives next door.
2. *Whom* as direct object:
   My father sometimes drives to work with Ben Jones, whom he has known for years.
3. *Whom* as object of the preposition:
   Ben Jones, with whom my father often drives to work, is a highway engineer.
4. *Which* as subject:
   We don't like the noise from the North Expressway, which runs near our house.
5. *Which* as direct object:
   The North Expressway, which Ben Jones helped to design, is one of the best in the country.
6. *Which* as object of the preposition:
   The fastest route to town is the North Expressway, on which you can always see a lot of traffic.

16.9 By referring to Lessons Thirteen and Sixteen, find examples to illustrate the following:

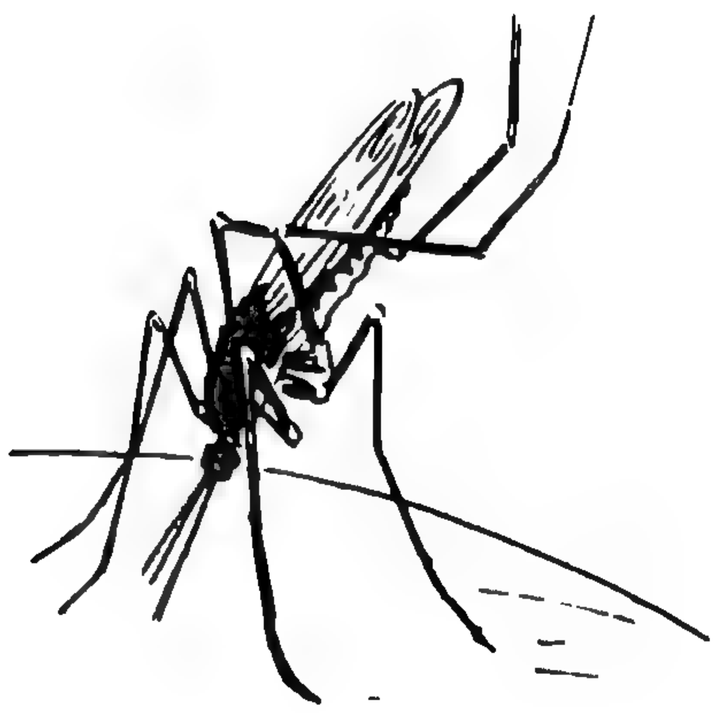
Restrictive	*Nonrestrictive*
1. *who* as subject	*who* as subject
2. *whom* as direct object *that* as direct object nothing (ϕ) as direct object	*whom* as direct object
3. *whom* as object of preposition *that* as object of preposition nothing (ϕ) as object of preposition	*whom* as object of preposition
4. *that* as subject	*which* as subject

Unit 5: BREAKTHROUGHS IN MEDICINE

Pasteur's discoveries

Surgery without pain

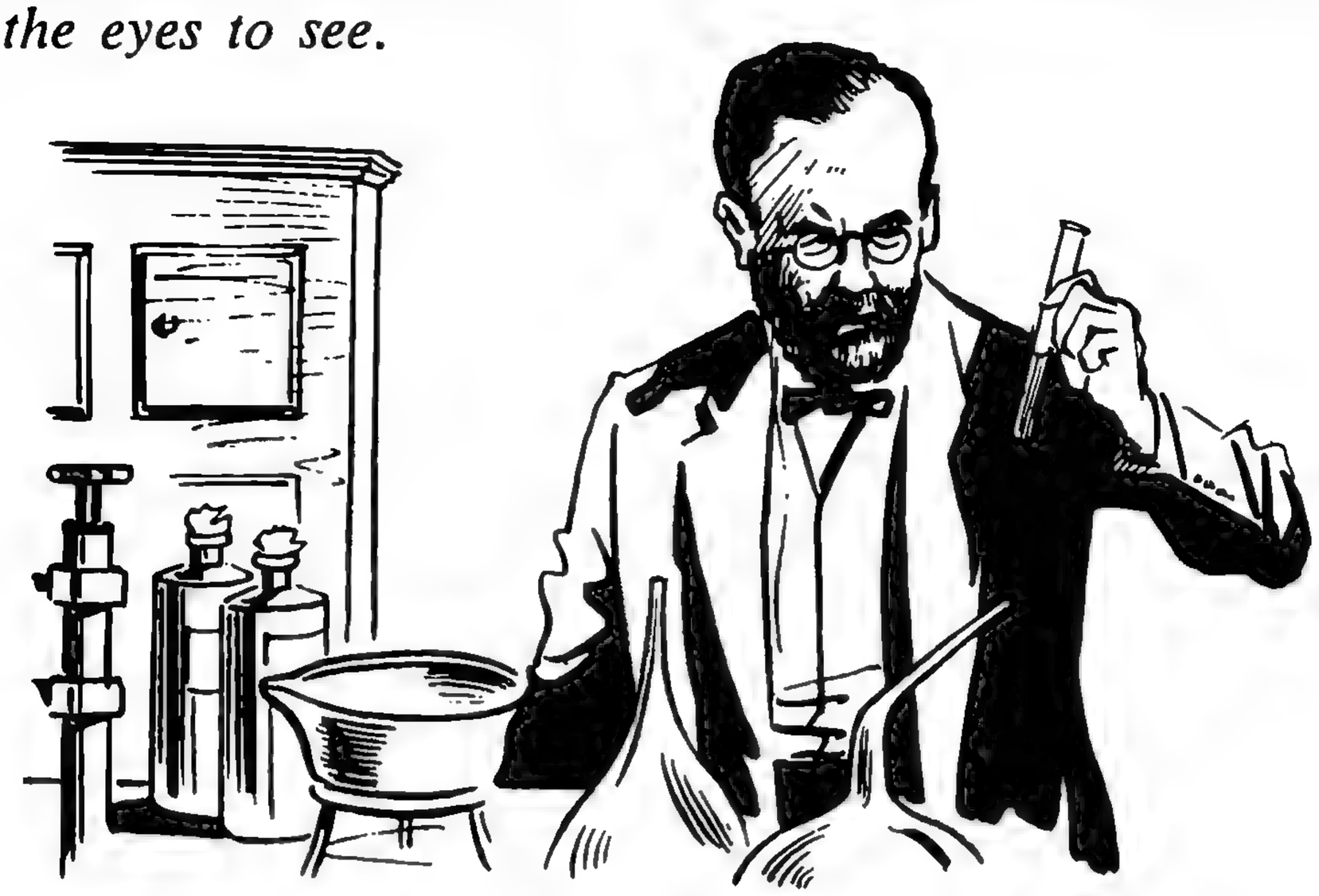
Man and the mosquito



Modern drugs

Seventeen: THE DISCOVERY OF DISEASE–CAUSING BACTERIA

Louis Pasteur discovered that some diseases are caused by plants too tiny for the eyes to see.



Pasteur in his laboratory

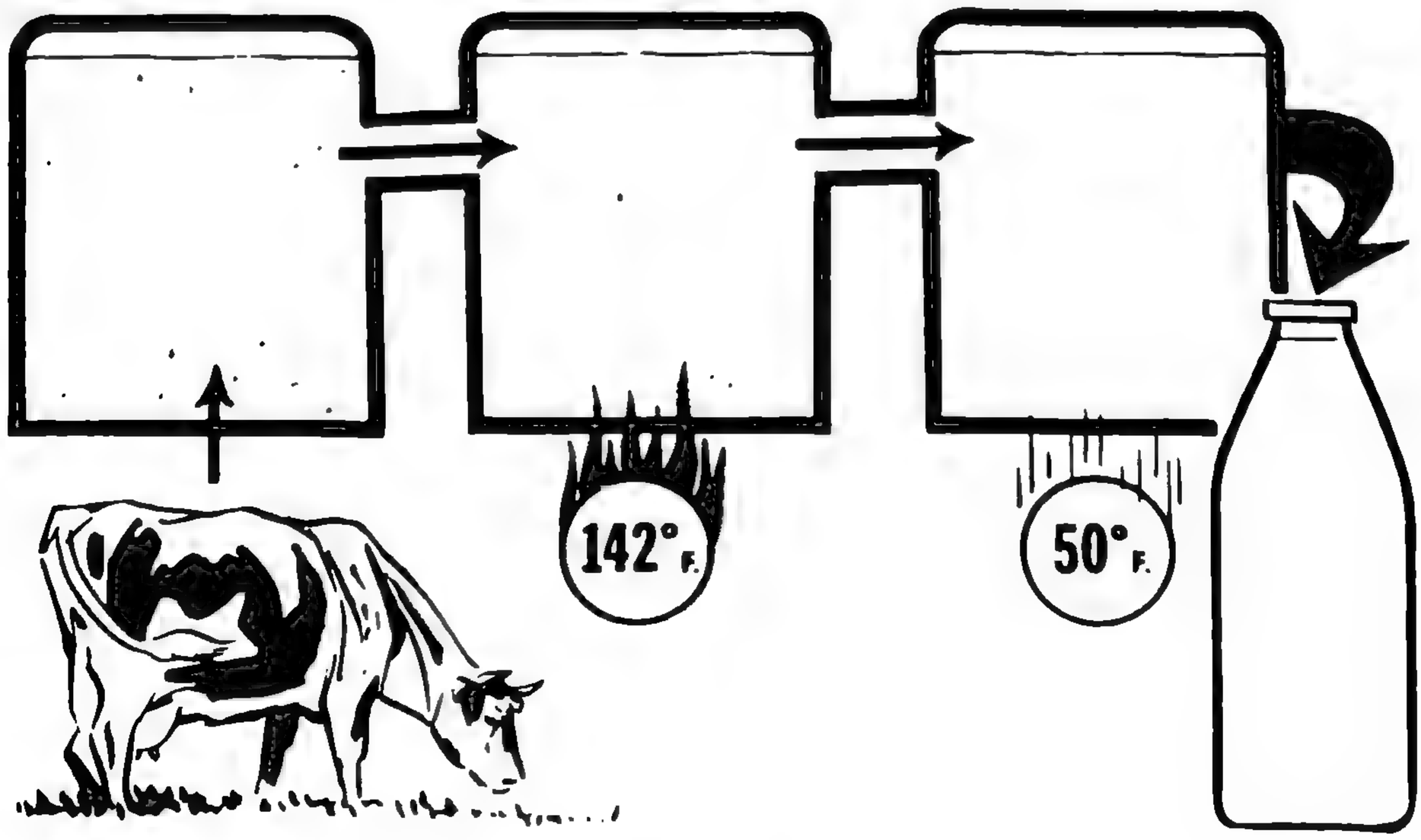
1] It was Paris in 1885. A nine-year-old boy named Joseph Meister had been bitten by a mad dog. Surely there was no way to save him. Soon the dreaded stiffness would spread throughout his whole body. But his mother would not give up hope. She had heard of a professor of chemistry who had been experimenting with rabies. So she hurried to the home of this professor, Louis Pasteur, to ask for help.

2] But Pasteur had been experimenting with animals. He did not know whether his treatment would be successful with human beings. Now he had the chance to find out, for if he did not try to do something, the boy would surely die. He gathered his materials together and went with Mrs. Meister. Within a few minutes he had injected a very weak fluid into Joseph's body. Then he waited. He gave another injection, stronger than the first. In all, about a dozen shots, or injections, were needed. Day by day [1] Pasteur grew more worried. But when he saw that Joseph failed to develop any symptoms of the disease, Pasteur knew that the injections were taking effect. He knew that he had found a cure for the dreaded rabies.

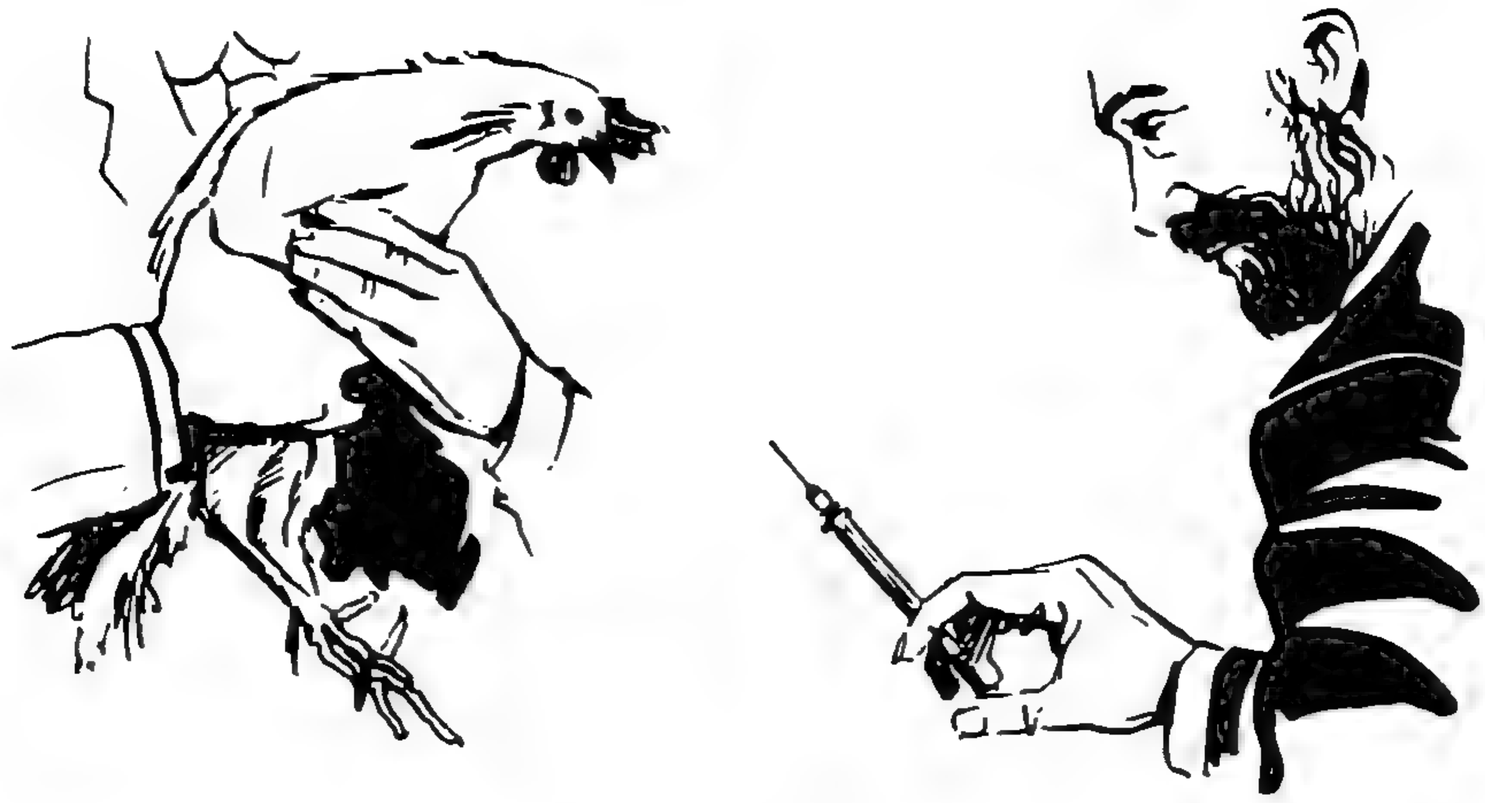
3] This miraculous cure was not the result of an accident. Louis Pasteur had been patiently experimenting for years with the cause and cure of disease. Early in his career, when he was teaching at a school of science in Lille, he was asked by a wine manufacturer to try to find a way to control the process of fermentation. Fermentation is the name for the chemical change by which the sugars in the grape become alcohol. Up to this time, most people believed that fermentation was caused by chemicals. But Pasteur startled the world by showing that the process was caused by tiny living plants called *bacteria*.

4] These bacteria, Pasteur soon found, were present not only in fermenting wine but also in milk, and if they were not controlled, the milk would quickly turn sour.[2] By heating the milk to 142 degrees Fahrenheit, Pasteur discovered, the bacteria could be destroyed and milk could be kept fresh for longer periods. This process is now named *pasteurization* after its discoverer.

5] Pasteur was convinced that bacteria live all around us. He believed that they are in the air, in the water, in our food, and even in our bodies. Some of them are useful, and some of them are harmful. If the harmful organisms are kept out of our food and water—if the food and water can be kept pure—then we can avoid many of the common diseases.



Pasteurizing milk



Inoculating chickens

6] Pasteur also discovered the process of *immunization*. When he was experimenting with causes of chicken cholera, he began to inoculate healthy chickens with weak cholera bacteria. After inoculation the chickens became only slightly ill. And later, when he inoculated the chickens with normal cholera bacteria, the chickens did not get the disease. Thus Pasteur discovered that the body builds protective substances called *antibodies* in the blood. These antibodies, which attack harmful bacteria, can be formed by injections of small amounts of the bacteria themselves. For thousands of years, men had known that certain diseases attack people only once. Now Pasteur had shown what this process of immunization was and how it could be used to control diseases.

7] Rabies was one of these diseases. Pasteur was convinced that the disease was caused by bacteria that attacked the central nervous system. Eventually, with the steady patience of a devoted scientist, Pasteur discovered that the spinal cord of infected animals contained a substance that could cause the disease. Injections of this substance into other laboratory animals proved he was right. Gradually he learned how to give small injections of the bacteria so that the animals would develop an immunity but would not contract the disease.

8] When Joseph Meister recovered, the world suddenly became aware of the greatness of an obscure French chemist named Louis Pasteur. Scientists today who are developing cures for infectious diseases still rely on the basic insights he provided: that diseases can be caused by bacteria and other tiny organisms, and that these bacteria can be controlled.

Understanding Ideas

1. Why wasn't Pasteur sure that the injections would cure Joseph Meister? Hadn't his experiments been successful? (paragraphs 1 and 2)

2. What did Pasteur discover about the cause of fermentation? Why was his discovery so startling? (paragraph 3)

3. How does pasteurization make milk safe to drink? Are bacteria found in foods other than milk? (paragraphs 4 and 5)

4. How does immunization prevent disease? (paragraph 6)

Applying the Reading

1. How have Pasteur's discoveries benefited you personally? Do you drink pasteurized milk? Have you been immunized against any diseases?

2. How have Pasteur's discoveries benefited your community? How many serious diseases have been controlled by immunization? Has everyone in your community been immunized for certain diseases?

Composition

1. Use the following topic sentences to write three paragraphs:
   a. When he studied fermentation, Pasteur made a startling contribution to the treatment of disease in humans.
   b. Every day our food is protected by Pasteur's discovery.
   c. Pasteur discovered that the body could gradually build up antibodies.

2. Prepare a report on one of the following topics:
   a. A visit to a nearby dairy or farm where milk is produced. Include a paragraph on how the milk is processed.
   b. A visit to a nearby clinic. Include a paragraph on the various kinds of injections that are given: for smallpox, for yellow fever, etc.

GRAMMAR REVIEW: Adjective + Infinitive

Model: Pasteur was happy.
He saw the boy recover.
. . . to see the boy recover.
Pasteur was happy to see the boy recover.

17.1 Follow the model as you construct sentences with an adjective + an infinitive.

1. I'm willing.
   I'll take my medicine.
   . . . _____
   _____
2. Pasteur was determined.
   He proved that bacteria caused disease.
   . . . _____
   _____
3. The patient was wise.
   He obeyed the doctor's orders.
   . . . _____
   _____
4. The doctors were anxious.
   They stopped the epidemic.
   . . . _____
   _____
5. The nurse was careful.
   She gave the right medicine.
   . . . _____
   _____

17.2 Make sentences of your own using the following phrases.

1. wasn't able to
2. am free to
3. have been ready to
4. were being careful to
5. is foolish to
6. should be certain to

Adjective + *Enough* + Infinitive

Model: Pasteur was confident enough . . .
He tried out his unusual theories.
. . . to try out his unusual theories.
Pasteur was confident enough to try out his unusual theories.

17.3 Follow the model to construct sentences with *enough* + infinitive.

1. The patient felt well enough . . .
   He ate some soup.
   . . . _____
   _____

2. Joseph felt strong enough . . .
   He walked around the room.
   . . . _____
   _____

3. The nurse was kind enough . . .
   She helped him walk.
   . . . _____
   _____

4. Pasteur was patient enough . . .
   He kept searching for a cure.
   . . . _____
   _____

5. She was sick enough . . .
   She went to the doctor.
   . . . _____
   _____

6. The injections were powerful enough . . .
   They cured the disease.
   . . . _____
   _____

7. Pasteur's discoveries were important enough . . .
   They changed the history of medicine.
   . . . _____
   _____

Too + Adjective -|- Infinitive

Model: The patient was too sick . . .
He didn't eat his dinner.
. . . to eat his dinner.
The patient was too sick to eat his dinner.

17.4 Follow the model to construct sentences with *too* -|- adjective + infinitive.

1. Pasteur was too courageous . . .
   Pasteur didn't let criticism stop him.
   . . . _____
   _____
2. Bacteria are too tiny . . .
   They cannot be seen with the naked eye.
   . . . _____
   _____
3. The boy was too frightened . . .
   He wouldn't take the injection.
   . . . _____
   _____
4. The injections were too weak . . .
   They didn't kill the bacteria.
   . . . _____
   _____
5. The pain was too horrible . . .
   It couldn't be described.
   . . . _____
   _____
6. She was too lazy . . .
   She didn't take her medicine.
   . . . _____
   _____
7. The beds were too hard . . .
   The beds weren't comfortable.
   . . . _____
   _____

Model: The patient was too weak to walk.
The patient wasn't strong enough to walk.
(*too weak to* → *not strong enough to*)

17.5 Use the opposite adjective and make the necessary changes.

1. The baby was too young to talk.
(*young* → *old*) _____
2. He wasn't tall enough to reach the medicine on the shelf.
(*tall* → *short*) _____
3. He wasn't patient enough to work in the laboratory.
(*patient* → *impatient*) _____
4. The banana was too green to eat.
(*green* → *ripe*) _____
5. The pills were too big to swallow easily.
(*big* → *small*) _____

17.6 Decide what the meaning should be and then add *too* before the adjective or *enough* after the adjective.

1. The patient was _____ nervous _____ to sleep.
2. The patient felt _____ well _____ to eat.
3. The nurse was _____ tired _____ to stay awake.
4. The patient wasn't _____ hungry _____ to finish his dinner.
5. The patient was _____ weak _____ to talk.
6. The doctor was _____ busy _____ to answer the telephone.
7. The doctor was _____ clever _____ to diagnose the illness.
8. The patient wasn't _____ sick _____ to go to the hospital.
9. The patient didn't feel _____ well _____ to leave the hospital.
10. The nurse was _____ impatient _____ to work with children.

17.7 Make sentences of your own using the following phrases.

1. too tired to/tired enough to
2. too old to/old enough to
3. too sick to/sick enough to
4. too weak to/weak enough to
5. too big to/big enough to

Eighteen: SURGERY WITHOUT PAIN

A new freedom is born—freedom from pain in surgery.

Morton was ready to inhale the ether himself.

1] In the winter of 1844 a young man named William Morton began his studies at Harvard Medical College in Boston. He had no money for his education, and he was struggling hard to support himself. In those days no special training was required to pull teeth. So young Morton worked hard as a dentist in order to pay his way through school.[1]

2] Like his fellow dentists, Morton was bothered by the great pain that his patients had to suffer. Many people were so afraid to have their teeth pulled that they would suffer for years before going to a dentist. While a tooth was being pulled, patients would scream with pain. They often had to be tied to the chair so that the dentist could work. When the tooth finally came out, both patient and dentist would be exhausted.

3] As he walked through the hospitals, young Morton could hear the screams of patients in operating rooms. He heard lecturers sorrowfully telling their students that sometimes the pain of surgical operations was so great that a patient would die from shock. Little wonder that [2] the young medical student was concerned with the problem of pain. And little wonder that when he finished medical school, he began to experiment with ways of relieving it.

4] At first Morton considered the possibility of putting the patient into a trance during surgery. But another solution occurred to him [3] after a visit with Dr. Charles Jackson, who was both a geologist and a chemist. Dr. Jackson often experimented with gases, particularly nitrous oxide and ether. During the conversation Dr. Jackson mentioned that he had once accidentally inhaled some ether and had become unconscious. After a few minutes he had recovered consciousness without any memory of what had happened while he was unconscious.

5] Morton thought of this conversation when he read that nitrous oxide gas also had a similar effect. From his medical books he learned Sir Humphry Davy had experimented with this gas and had observed how some people who had inhaled nitrous oxide had become insensible and were unable to feel pain. For this reason Davy concluded that the gas might be useful in surgical operations. But since he could find no evidence that the gas had ever been used for this purpose, Davy did not carry his work any further.

6] One evening Morton decided to put Davy's conclusion to the test.[4] He cautiously poured some ether into a cloth. Then he walked toward his dog and, holding him gently, placed the ether near his nose. In a few moments the dog slumped to the floor. Morton examined the animal and noticed that the breathing and heartbeat were normal. After a few minutes, the dog awakened and wagged his tail.

He placed the ether near the dog's nose.

7] The next day he began to experiment on other animals. In all cases the results were the same. Now he was ready to take the final step, to inhale the ether himself. He shut himself in his room and began to breathe the ether fumes. He soon lost consciousness. When he recovered, he felt a numbness in his arms and legs. He was

only partially conscious and feared for a few minutes that he might not fully recover. Then gradually he felt a slight tingling in his fingers. He looked at his watch and found that he had been unconscious for about seven minutes. He was delighted with the success of this experiment, but his wife was horrified when he told her about it. "I was sick at heart," [5] she said later, "for the thought came to me [6] that he might have died there alone."

8] Morton had only one thought now. He wanted to try the experiment again and at once. He waited for the chance to try ether on a patient in pain.[7] Two days later the chance came.[8] A man who was in great pain from a bad tooth came into Morton's office. With the man's permission, the young dentist applied the ether [9] and the man lost consciousness.[10] In a moment, the tooth was out. When the patient regained consciousness, he was amazed to find that the tooth had been pulled, for he had felt nothing.

9] Morton hardly heard the words of praise that came from his patient. He was thinking, "If ether can prevent pain when a tooth is pulled, why can't it prevent pain during an operation?" Soon he had a chance to test his idea. Dr. John Collins Warren, a surgeon, agreed to a demonstration before an audience of doctors and medical students. After Morton applied the ether, he turned to the surgeon and said, "Your patient is ready, Doctor."

10] Swiftly and with a precision never before possible, Dr. Warren removed a large tumor from the neck of the patient. None of the spectators moved. Never before had such a thing been seen. No straps held the patient to the operating table, no loud screams were heard, no twisting of arms and legs interfered with the surgeon's work. At last the surgeon turned to the gallery and said, "Gentlemen, this is no humbug." [11] Students and doctors cheered as Dr. Morton shook hands with Dr. Warren. They all knew that a new freedom had been born—freedom from pain in surgery.

"Your patient is ready, Doctor."

Understanding Ideas

1. Why was young Morton so concerned about the problem of pain? (paragraphs 2 and 3)

2. What did Morton learn from his conversation with Dr. Jackson and from his medical books? (paragraphs 4 and 5)

3. How did Morton first put Davy's conclusion to the test? What is the final step he took before he was willing to try ether on his patients? (paragraphs 6 and 7)

4. Describe Morton's first use of ether with a patient in his own office. (paragraph 8) Describe his use of ether with a patient on the operating table. (paragraphs 9 and 10)

Applying the Reading

1. Have you ever had a cavity filled or a tooth pulled in a dentist's office? What did your dentist do to prevent pain? Did he use gas? Did he give you an injection? How much pain did you feel?

2. Have you ever had an operation? Do you have a relative or friend who has had an operation? If so, try to find out about the kind of anesthetic that was used.

Composition

1. Use the following topic sentences to write three paragraphs:
   a. Morton, like all scientists, built on the work of other researchers.
   b. In the process of discovering ether as an anesthetic, Morton showed remarkable personal courage.

2. Prepare either an oral or written report on one of the following topics:
   a. A visit to a dentist's office. Include a paragraph on what the dentist does to prevent pain.
   b. A visit to a hospital. Include a paragraph on what the doctors do to prevent pain.

GRAMMAR REVIEW: Infinitives in Sentences with *It*

Model: It was painful.
Morton saw so much suffering.
. . . for Morton to see so much suffering.
It was painful for Morton to see so much suffering.

18.1 Follow the model as you construct sentences with *for* + infinitive.

1. It was difficult.
   Morton gave ether to the dog.
   . . . for _____
   It _____
2. It was possible.
   He experimented with a dog.
   . . . for _____
   It _____
3. It was exciting.
   He watched the dog wake up and wag his tail.
   . . . for _____
   It _____
4. It was necessary.
   He tried the experiment on himself.
   . . . for _____
   It _____
5. It was disturbing.
   He felt a numbness in his arms and legs.
   . . . for _____
   It _____
6. It was surprising.
   He found he had been unconscious seven minutes.
   . . . for _____
   It _____
7. It was comforting.
   The patient knew he would feel no pain.
   . . . for _____
   It _____

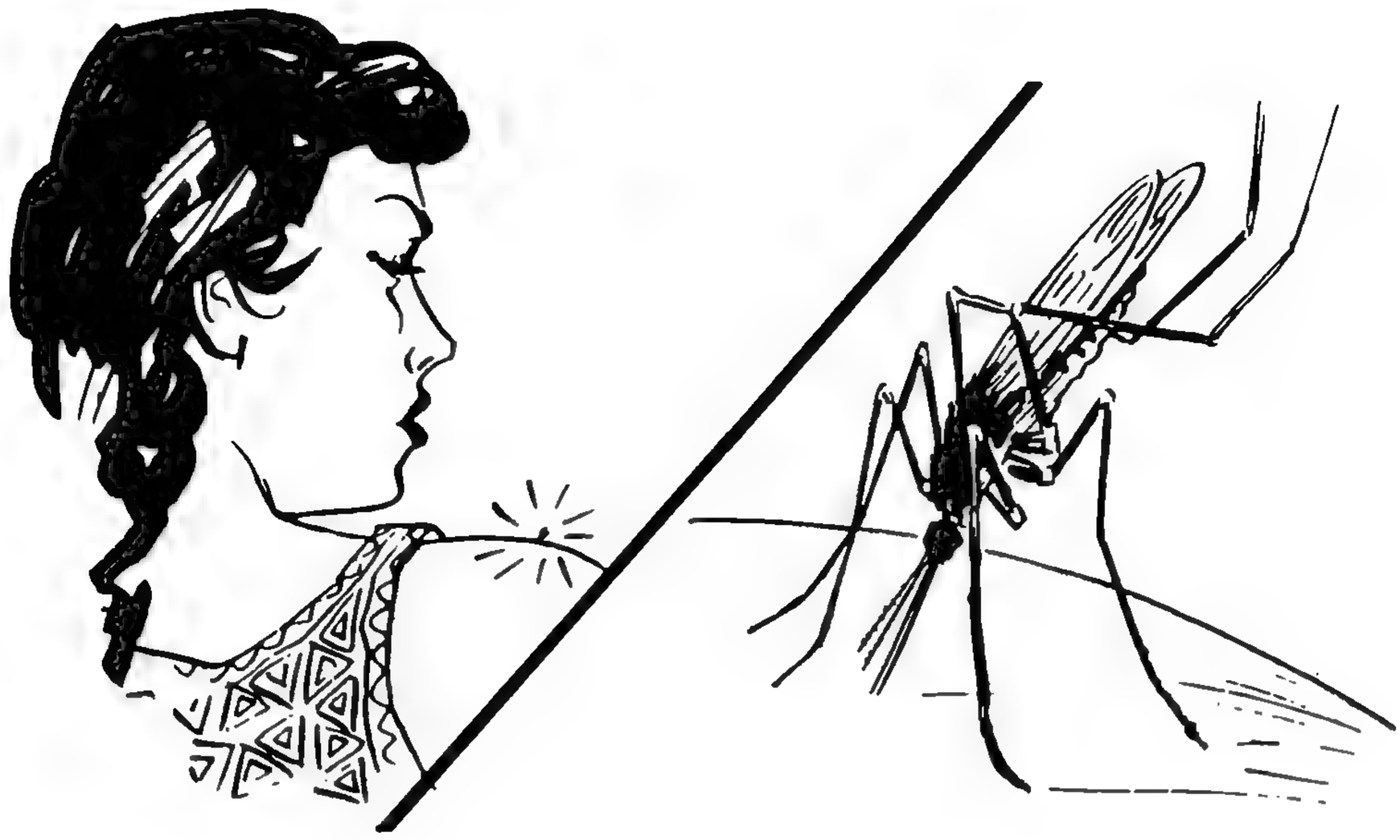
Model: It was painful for Morton to see so much suffering.
It was painful to see so much suffering.
Morton found it painful to see so much suffering.

18.2 Follow the model as you make two more sentences.

1. It was difficult for Morton to give ether to the dog.
   It _____
   Morton found _____
2. It was possible for Morton to experiment with a dog.
   It _____
   Morton found _____
3. It was exciting for Morton to watch the dog wake up and wag his tail.
   It _____
   Morton found _____
4. It was necessary for Morton to try the experiment on himself.
   It _____
   Morton believed _____
5. It was disturbing for Morton to feel a numbness in his arms and legs.
   It _____
   Morton reported _____
6. It was dangerous for Morton to inhale the ether.
   It _____
   Morton thought _____
7. It was easy for Morton to pull the tooth when the patient was unconscious.
   It _____
   Morton found _____
8. It was rewarding for Morton to know he had conquered pain.
   It _____
   Morton found _____
9. It was comforting for the patient to be told he would feel no pain.
   It _____
   The patient found _____
10. It was essential for Morton to consult Dr. Jackson.
    It _____
    Morton thought _____

Nineteen: MAN AND THE MOSQUITO

Controlling the mosquito means controlling malaria and yellow fever.



Part I

1] Have you ever heard the high, steady whine of a mosquito during a quiet evening? Can you remember your uneasiness when that noise suddenly stopped? You knew that the mosquito might have flown away or that he might have settled somewhere on a wall. But you knew also that he might be getting ready to bite you.

2] Actually it would be more accurate to say *she* might be getting ready, for only the female mosquito bites. When she finds an animal or a human, she pushes a sawing tube [1] into the skin. Then she forces a fluid into the blood to keep it from hardening as it meets the air. Finally, with a strong sucking movement, she drinks her fill.[2] Then she flies away, leaving an annoying bite that itches for several hours or even for several days.

3] But with certain kinds of mosquito, that bite might be more than annoying. It might be deadly. From their mouths might come numbers of small organisms called parasites. One kind of parasite causes malaria; another kind causes yellow fever. For thousands of years, men have known the terrible sicknesses caused by these parasites. But no one knew that it was a mosquito that carried malaria and yellow fever.

4] When the Spanish explorers came to South America in the seventeenth century, they found that the people there were able to control malaria through a drug called *quinine,* which they made from the bark of a certain tree. Later, artificial malaria drugs were developed. German scientists developed an artificial quinine called *atabrine,* and in the United States a group of scientists developed a drug that is very much like the original quinine. But all these drugs only control the disease. They do not prevent it. Before malaria could be stamped out,[3] scientists had to discover the way in which the disease was transmitted.

5] Louis Pasteur led the way when he found that microscopic organisms enter the body and cause many of man's diseases. Following Pasteur's announcement, a Frenchman named Charles Laveran discovered malaria parasites in the blood of a sick man. When these parasites entered the blood, they buried themselves in the tiny red cells [4] and released poisons into the bloodstream.[5] These poisons then caused violent waves of fever [6] that would weaken the patient.

6] A physician, Sir Ronald Ross, was the first to prove that malaria was transmitted by mosquitoes. Ross was born in India. After receiving his medical degree in England, he returned to the country of his birth to work in the Indian Medical Service. In 1895 Ross met Sir Patrick Monson, the first man to suggest that malaria was transmitted by mosquitoes. After two years of research Ross proved beyond a doubt [7] that Monson was right. A certain kind of mosquito—the *anopheles*—was the carrier of malaria.

Sir Ronald Ross in his laboratory in India

7] In another part of the world, a yellow fever plague had struck [8] Havana, Cuba, with terrible losses to the population. The disease would attack the victim's kidneys, liver, and other organs. Intense fever left him helpless. Of those who caught the disease, 50 to 90 percent died within three days. Though malaria could be controlled through quinine, there was little or no medical help for the yellow fever victim. And no one knew the cause of yellow fever.

8] Shortly after Pasteur's discoveries about bacteria, Carlos Juan Finlay, a Cuban physician, had guessed that the mosquito was the cause of yellow fever. As early as 1881 he had written papers presenting his theory.[9] In the years that followed, he continued to build up his case [10] against the mosquito, but no extensive experiments were begun until those of Dr. Walter Reed in 1900. Reed, an American army doctor, had been sent to Havana, Cuba, as head of a commission to find the cause and cure of yellow fever. Some people believed that the disease was spread through the clothing and bedding of sick persons. But after a number of experiments Reed and his associates proved Finlay's theory that a certain kind of mosquito was the carrier of yellow fever. The next step was to destroy the insect that caused it.

9] One way to destroy the mosquito is to destroy its breeding places. The mosquito must lay its eggs in standing water—that is, water that is not flowing. When engineers began to drain the swamps near Havana, the mosquitoes began to disappear. In 1876 Havana had a death rate of 81 persons out of 1,000 from yellow fever. In 1900 there were no deaths from the disease.

Engineers drained the swamps near Havana.

10] Another way of destroying the mosquito is by spraying. A powerful poison called DDT was developed that could be sprayed on ponds and standing water. DDT can be sprayed by hand or spread by an airplane flying over areas that are difficult to reach. For a time DDT worked wonders [11] in reducing the number of mosquitoes. But the promise of DDT did not last long. It became evident that the mosquitoes were developing an immunity to the poison.

11] Other research findings show promise. Dramatic new mosquito repellents [12] have been developed in recent years, some of which have almost no odor for humans. When they are properly applied, the repellents will keep mosquitoes away for hours. Now insecticides are available in small cans. With these small cans of insecticides,[13] it is possible to spray a large room in minutes and keep it free of mosquitoes for hours.

12] Experiments have shown that one of the best mosquito controls is fish. Certain varieties of fish, among them the members of the perch family, are especially useful. The fish will swim around the pond or lake and eat the mosquito eggs before they have time to hatch.

Planting mosquito-eating fish

13] So research continues to reveal new ways to control the mosquito. Every day we come closer to this goal. Once it is achieved, and these harmful insects are destroyed completely, there will be no more malaria or yellow fever.

Spraying swamps by plane

Understanding Ideas

1. Describe how the female mosquito gets the blood she lives on. How could a mosquito bite be deadly? (paragraphs 2 and 3)

2. What drugs have been used to control malaria? Where do the drugs come from? (paragraph 4)

3. What scientific discoveries led to the control of malaria? Describe the contributions of Pasteur, Laveran, Ross, and Monson. (paragraphs 5 and 6)

4. What scientific discoveries led to the control of yellow fever? Describe the contributions of Finlay and Reed. (paragraph 8)

5. What are some of the ways in which the mosquito can be destroyed? (paragraphs 9, 10, 11, 12)

Applying the Reading

1. What are some of the commonest insects in your area? Which of them are harmful—that is, which of them are carriers of disease, and which of them have poisonous bites?

2. Was either yellow fever or malaria ever prevalent in your area? If so, what steps have been taken to control these diseases?

Composition

1. Use the following topic sentences to write three paragraphs:
   a. The controlling of malaria and yellow fever shows that scientific research is international.
   b. The men who worked in the swamps controlling malaria faced more dangers than the scientists in the laboratory.
   c. There are a number of ways to destroy the mosquito.

2. Prepare a report on one of the following. topics:
   a. The kinds of insecticides used in your community.
   b. Insects in your area that are carriers of diseases.

GRAMMAR REVIEW: From Adjective + Infinitive to Noun + Infinitive

Model: It was well-known.
Reed was eager to experiment.
(*eager* → *eagerness*)
Reed's eagerness to experiment . . .
Reed's eagerness to experiment was well-known.

19.1 Construct sentences with a noun + an infinitive.

1. It is essential.
   The doctor is willing to read medical journals.
   (*willing* → *willingness*)

   _____

   _____

2. It brought him success.
   He was determined to find a cure.
   (*determined* → *determination*)

   _____

   _____

3. It made him famous.
   He was ready to try out new ideas.
   (*ready* → *readiness*)

   _____

   _____

   It was apparent.
   He was anxious to become a doctor.
   (*anxious* → *anxiety*)

   _____

   _____

5. It was doubtful.
   He was not competent to diagnose the illness.
   (*competent* → *competence*)

   _____

   _____

6. It was astounding.
   The patient was able to recover.
   (*able* → *ability*)

   _____

   _____

In Order + Infinitive

Model: They used quinine. They treated malaria.
They used quinine in order to treat malaria.
They used quinine to treat malaria.

19.2 Follow the model as you construct two more sentences.

1. Reed watched the mosquitoes. He learned about their habits.

_____

_____

2. Reed needed money. He tested Finlay's theory.

_____

_____

3. Many men risked their lives. They drained the swamps.

_____

_____

4. They used airplanes. They sprayed the swamp with DDT.

_____

_____

5. They planted fish. They got rid of the mosquitoes.

_____

_____

Model: "Don't let the spray touch the food."
The doctor warned them not to let the spray touch the food.

19.3 Follow the model as you make new sentences with *not to*.

1. "Don't be afraid."
   The nurse told the patient _____
2. "Don't change your mind."
   The patient's wife advised him _____
3. "Don't take any more medicine."
   The doctor told the patient _____
4. "Don't sleep without mosquito nets."
   They warned us _____
5. "Don't depend on DDT alone."
   They told us _____
6. "Don't scratch mosquito bites."
   The doctor warned us _____

Twenty: THE SEARCH FOR NEW DRUGS

New and powerful killers of bacteria are constantly being discovered.

Fleming discovers penicillin.

1] After Pasteur announced that infections were caused by bacteria, many scientists began to study these tiny organisms. Soon they were able to identify many kinds of bacteria that caused diseases. Much later an even tinier kind of infective agent called a *virus* was discovered. All this new information about bacteria and viruses helped scientists find out more about the cause and cure of infectious disease.

2] One of the most powerful killers of bacteria and viruses was discovered quite by accident in the fall of 1928. At that time, in his basement laboratory in London, a bacteriologist, Dr. Alexander Fleming, was looking for a substance that would kill deadly bacteria. In order to observe their growth, he had spread on his laboratory desk some small plates containing the bacteria. One evening he accidentally failed to place a cover on one of the plates.

3] When Fleming arrived the next morning, he saw that the plate had gathered mold during the night. This did not surprise him, for the basement was damp and ventilated only by a partly opened window. But what he saw next *did* surprise him. Around the outside of the uncovered plate the bacteria were still flourishing, while in the area close to the mold there were none. They had somehow disappeared. He transferred the mold, which he named *penicillin,* to a clean plate and let it multiply for two weeks. Then he began to experiment and found it would destroy bacteria in a test tube. Would it, he wondered, do the same to bacteria in the human body?

4] In 1929 Fleming wrote a report of his laboratory experiments, presented it at a medical meeting, and had it printed in scientific journals. But for ten years, while he continued to experiment with penicillin, his important news was largely ignored by the scientific world.

5] Meanwhile another powerful killer of bacteria and viruses was also discovered by accident. In Germany a group of scientists were working on the improvement of dyes that were used for colors in the textile industry. One of the scientists, whose name was Domagk, injected a small amount of one of the red dyes into some mice that were dying from an infection. The mice recovered quickly. After further experiments, Domagk derived a drug from the red dye that became known as the first of the *sulfa* drugs.

6] When the discovery of the sulfas was announced in 1935, scientists in many parts of the world eagerly studied ways to improve them. New and better forms were developed. Methods of handling, manufacturing, and applying the drugs were perfected. Many dreaded diseases, including scarlet fever and leprosy, responded to [1] the sulfas. Within a few years, two scientists in England developed a sulfa that could cure pneumonia, a disease that up to that time had been responsible for thousands of deaths yearly. The sulfas often cured so rapidly and dramatically that they became known as "wonder" or "miracle" drugs.

7] Unfortunately the new sulfas were used not only widely but indiscriminately, and it soon became clear that they sometimes caused

Dr. Domagk injecting a dye into mice

serious side effects.[2] Though they might cure the disease, they might at the same time cause serious reactions. The sulfa drugs are tiny crystals that disappear into the bloodstream and retard the bacteria's growth. If a patient takes the sulfas over a long period of time, the crystals do not dissolve. They find their way into certain parts of the body where they collect. They might collect in the kidney, for example, and interfere with its functioning. Some people develop skin rashes when they are taking sulfas. But if doctors prescribe sulfa drugs with care, many of these dangerous side effects can be prevented.

8] As scientists became aware of the limitations of sulfa drugs, they became more interested in Dr. Fleming's penicillin. In 1938 a team of English scientists came upon Fleming's report in an old medical journal and began to improve and test the drug. In 1941 it was declared safe for use on humans and made available to doctors. As the drug was produced in quantity, it became cheaper. And the reduced cost has made possible worldwide use of penicillin in treating many infections.

9] Unlike the sulfa drugs, which are hard crystals, the penicillins are made up of [3] plant material that the body can eventually absorb. But penicillin, like sulfa, has its harmful side effects. Frequently it causes only an unpleasant reaction, such as skin rash or a light fever. Occasionally it produces more harmful reactions, even causing the death of those who are allergic to it. Yet it still remains a miracle drug that has saved the lives of thousands of persons.

10] Penicillin is generally considered foremost in a long series of "antibiotics," each having the power to kill certain types of bacteria. Streptomycin, aureomycin, terramycin—the list is long and impressive. Each, in turn,[4] is studied and experimented with, always with the hope of someday discovering even more powerful healing agents.

Penicillin by pill

Penicillin by injection

Understanding Ideas

1. Reread paragraphs 1, 2, and 3. Then, without referring to the book, tell your class the story of Fleming's discovery of penicillin.

2. How did Domagk discover the sulfas? (paragraph 5)

3. What are some of the diseases that the sulfas can cure? Why must doctors prescribe sulfa drugs with care? (paragraphs 6 and 7)

4. How widely is penicillin used today? Why must doctors be careful in prescribing penicillin? (paragraphs 8 and 9)

Applying the Reading

1. Are there any drugs that you cannot buy without a prescription? Why are laws that limit the sale of drugs necessary?

2. What are some of the new drugs widely available in your country? What diseases are these drugs prescribed for?

Composition

Write complete compositions of three or four paragraphs using the following topics as your central thoughts. You will find all the information you need in the readings for Unit 5:

a. Scientists nearly always depend on the work of other scientists.
b. In medical research we owe much to animals.
c. Scientists share information internationally.

GRAMMAR REVIEW: *-ing* Phrases as Objects

Model: Fleming admitted it.
He discovered penicillin accidentally
. . . discovering penicillin accidentally.
Fleming admitted discovering penicillin accidentally.

20.1 Follow the model as you construct sentences with *-ing* phrases as objects.

1. The patient feared it.
   The patient got a penicillin shot.
   . . . _____
   _____

2. The doctor tried it.
   He injected the dye into some mice.
   . . . _____
   _____

3. They have finished it.
   They gave the injections.
   . . . _____
   _____

4. He didn't mind it.
   He swallowed the large pills.
   . . . _____
   _____

5. The patient remembered it.
   She took the sulfa an hour ago.
   . . . _____
   _____

6. They considered it.
   They gave everyone in the village some penicillin.
   . . . _____
   _____

7. The doctor has suggested it.
   He immunized everyone.
   . . . _____
   _____

Phrases with Nominal + *-ing* That Replace Objects

Model: The nurse saw it.
The patient was taking the wrong medicine.
. . . the patient taking the wrong medicine.
The nurse saw the patient taking the wrong medicine.

20.2 Follow the model as you construct sentences with nominals + *-ing* phrases.

1. Fleming observed it.
   The bacteria were flourishing around the outside of the dish.
   . . . the bacteria _____
   Fleming _____
2. The patient felt it.
   The cold air was coming from the open window.
   . . . the cold air _____
   The patient _____
3. I heard it.
   The doctor was telephoning a prescription to the druggist.
   . . . the doctor _____
   I heard _____
4. The scientist noticed it.
   The mice were getting better.
   . . . the mice _____
   The scientist _____
5. The others watched it.
   Dr. Domagk was injecting the dye into a mouse.
   . . . Dr. Domagk _____
   The others _____
6. The visitor saw it.
   The nurse ran down the hall.
   . . . the nurse _____
   The visitor _____
7. The nurses had observed it.
   The doctor took the patient's temperature many times.
   . . . the doctor _____
   The nurses _____

NOTES ON THE READINGS

Unit 1: Transportation

ONE: TRANSPORTATION ON WHEELS

1. *Early automobiles,* the first automobiles made 2. *mass production,* production in very large numbers 3. *could afford,* had money to buy 4. *the whole world,* all the people in the world

TWO: TRANSPORTATION BY WATER

1. *catch the wind,* use the force of the wind 2. *in rough water,* when seas are not calm 3. *little by little,* gradually 4. *have broken all earlier records for speed and time submerged,* have traveled faster and stayed under water longer

THREE: TRANSPORTATION BY AIR

1. *salt air,* that is, the air coming from the sea, therefore salty 2. *flew under its own power,* flew by means of its own power 3. *builds up,* develops, is created 4. *faster than sound,* that is, faster than sound waves can travel, or over 700 miles an hour 5. *placed orders for,* ordered

FOUR: TRAVEL IN SPACE

1. *the new space age,* the present time, so called because of scientific concern with devices to explore the outer atmosphere and to travel to the moon and the planets 2. *kick of a gun,* the backward jerk 3. *shoot a man,* transport a man 4. *must go,* must travel at the speed of 5. *nose cone,* the front end of a rocket made to withstand great heat. 6. *Outer space,* beyond the earth's atmosphere. 7. *both of these,* that is, cosmic rays and tiny dust particles

Unit 2: Machines

FIVE: A CITY MAN IN THE MACHINE AGE

1. *heart of the big city,* center of, middle of 2. *in the machine age,* that is, at the present time, when machines are an important part of life 3. *an up car,* an elevator car going up 4. *billing customers,* preparing statements that indicate amounts of money owed by customers 5. *looks forward to,* eagerly anticipates

SIX: A FARMER IN THE MACHINE AGE

1. *pay its way*, be profitable 2. *in touch with*, in communication with

SEVEN: COMPUTERS: MACHINES WITH ELECTRONIC BRAINS

1. *a staggering amount*, so much as to stagger or overwhelm one's imagination 2. *races back*, is quickly transmitted back 3. *much less*, and it would be even more impossible to 4. *10-digit numbers*, for example, 1,000,000,000 5. *keeps track of sales trends*, keeps a record of whether sales are good or bad 6. *makes out company payrolls*, lists the salary due each employee 7. *what space*, that is, space in the airplane 8. *"has all the answers,"* is able to produce all the answers 9. *New York–New Jersey tunnels*, tunnels that connect New York and New Jersey 10. *Is it any wonder*, is it surprising 11. *in part*, partly, to a certain extent 12. *taking over*, replacing or assuming 13. *For some time to come*, for a long time yet in the future

EIGHT: THE SUN: A NEW SOURCE OF ENERGY

1. *one-twentieth of a horsepower*, that is, the power of twenty men equals the power of one horse 2. that is, the power that makes a car move equals the power of 2,000 men 3. *that of*, the energy of 4. *growing by leaps and bounds*, increasing very rapidly 5. that is, in a hundred years these limited supplies may have become exhausted 6. *take their place*, replace them 7. *free for the taking*, available without cost 8. *put it to work*, use it, make it work 9. *running out of*, having no more supplies of 10. *on a large scale*, extensively 11. *No wonder*, it is not surprising that

Unit 3: Communication

NINE: THE POSTAL SERVICE

1. *circles the globe*, extends all over the world 2. *fresh cut flowers*, flowers that have recently been picked 3. *speed up*, make quicker 4. *working with*, experimenting with

TEN: TELEGRAPH AND TELEPHONE

1. *stood for*, represented 2. *took them seriously*, considered them important 3. *worked out*, devised 4. *a happy accident*, a lucky discovery made by chance 5. *set in motion*, made to move

ELEVEN: RADIO AND TELEVISION

1. *lightships*, anchored ships that serve as lighthouses 2. *earphones*, instruments placed on the ears for individual reception 3. *has become worldwide*, is being used throughout the world 4. *can claim credit for*, can be called the sole inventor of

TWELVE: COMMUNICATIONS SATELLITES

1. *used up*, taken or assigned 2. *a very promising way*, a way likely to succeed 3. *close to reality*, almost possible to produce 4. *live television*, that is, the program is not recorded; it is being watched as it happens 5. *the naked eye*, the human eye unaided by any device

Unit 4: Our Changing Landscape

THIRTEEN: SUPERMARKETS

1. *check-out line*, a line of people waiting to have a clerk add up the cost of their purchases 2. *Years of trial and error*, years of learning by trying and making mistakes 3. *to save a penny here and there*, to save money with the purchase of several items since, according to the custom in American supermarkets, the more one buys of a certain item the less expensive that item is 4. *had rung the bell for the butcher*, to call the butcher 5. *on top*, that is, on the top side 6. *to meet the housewife's every need*, to satisfy all her requirements 7. *piped in*, received electrically over wires 8. *There's no doubt about it*, without question

FOURTEEN: SHOPPING CENTERS

1. *alive with*, containing many 2. *modern landscape*, scenery modified by man-built structures 3. *comes to*, reaches 4. *downtown areas*, areas in the center of town 5. *nothing more than*, only 6. *a strip of stores*, a series of stores 7. *set back from*, built slightly away from 8. *stock quotations*, news about the selling price of stocks and securities 9. *springing up*, rapidly appearing, being built 10. "*sense of closeness*," sense of intimacy 11. *have much to learn*, can learn a lot

FIFTEEN: MOBILE HOMES

1. *a beauty shop*, a place where women go to have their hair arranged, their nails polished, and so on 2. *suited to the pocketbook of*, not too expensive for 3. *Giving up*, leaving, abandoning 4. that is, the average park dweller moves only once in twenty-eight months 5. *for good*, permanently 6. *"It's the life for us!"* That is, "It's the best life for us!" 7. *pull-out rooms*, rooms that can be pulled out of the body of the trailer 8. *retired*, that is, from their jobs 9. *They have all shaken loose from*, all of them have gotten rid of 10. *one of every five buyers*, one-fifth of all the buyers 11. *make a down payment*, pay a small amount at first 12. *and take five to seven or more years to pay the balance*, and pay the rest of the money during fixed periods in the five to seven years that follow 13. *make their home in trailers*, make trailers their homes

SIXTEEN: SUPERHIGHWAYS

1. *headed north for Portland, Maine*, drove toward the city of Portland in the state of Maine, which lies northeast of Rhode Island 2. *bypassing of*, passing by without going through 3. *expressway*, a highway that has no roads crossing it, for fast driving 4. *network of superhighways*, interlacing system of superhighways 5. *Interstate System*, a system connecting the states of the United States 6. *open to traffic*, ready for use

Unit 5: Breakthroughs in Medicine

SEVENTEEN: THE DISCOVERY OF DISEASE-CAUSING BACTERIA

1. *Day by day*, day after day, every following day 2. *turn sour*, become sour

EIGHTEEN: SURGERY WITHOUT PAIN

1. *to pay his way through school*, to earn enough money in order to pay the expenses of his education 2. *Little wonder that*, it is not surprising that 3. *occurred to him*, came to his mind 4. *decided to put Davy's conclusion to the test*, decided to test Davy's conclusion 5. *sick at heart*, sad and disturbed 6. *came to me*, came to my mind 7. *in pain*, feeling pain 8. *the chance came*, the opportunity pre-

sented itself 9. *applied the ether,* that is, made him smell the ether 10. *lost consciousness,* became unconscious, lost his feelings and awareness 11. *this is no humbug,* this is not a trick; what happened was quite real

NINETEEN: MAN AND THE MOSQUITO

1. *a sawing tube,* a tube with an outside surface that has tiny teeth or projections 2. *she drinks her fill,* she drinks until she is satisfied 3. *stamped out,* done away with, destroyed 4. *red cells,* the blood contains red cells and white cells 5. *the bloodstream,* the general flow of blood through the body 6. *violent waves of fever,* sudden great changes in body temperature 7. *beyond a doubt,* without question 8. *had struck,* had suddenly appeared 9. *presenting his theory,* explaining his ideas to the public 10. *build up his case,* develop his theory 11. *worked wonders,* accomplished miracles 12. *mosquito repellents,* chemicals that keep mosquitoes away 13. *insecticides,* chemicals that kill insects

TWENTY: THE SEARCH FOR NEW DRUGS

1. *responded to,* reacted with positive results 2. *side effects,* unexpected reactions 3. *are made up of,* are composed of 4. *in turn,* one by one

GRAMMAR INDEX

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